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Guidance Material and Best Practices for MPL Implementation

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International Federation of Air Line Pilots' Associations
IFALPA
The Global Voice of Pilots

2nd Edition

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Guidance Material and Best Practices for MPL Implementation
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Executive Letter

Dear Colleagues,

It is our pleasure to introduce the Second Edition of the Guidance Material and Best Practices for MPL Implementation, which is now a cobranded IATA/IFALPA publication. This guide is the result of a collaborative effort between IATA and IFALPA, and its content is harmonized with ICAO.

MPL was adopted by the ICAO Air Navigation Commission (ANC) in November 2006 and is still a relatively new license that presents significant implementation challenges for both regulatory authorities and training organizations. There are robust MPL programs successfully producing well trained pilots around the world, but there is a critical need for harmonized guidance and best practices to assist training organizations when establishing their own MPL programs. This Second Edition of the Guidance Material and Best Practices for MPL Implementation represents an important resource for such information to be used at the operational level.

MPL is not just another license; it represents a shift in the ab-initio training philosophy, moving from prescriptive hours-based training to competency-based training and assessment in a multi-crew environment from the very beginning of the program. Safety is our number one priority and a well-trained pilot will contribute to the ultimate goal of improving aviation safety worldwide.

Rob Eagles
Senior Vice-President (a.i.)
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International Air Transport Association (IATA)

Captain Martin Chalk
President
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Definitions

Note: Most of the Definitions come from *Annex 1 — Personnel Licensing*, *Annex 6 — Operation of Aircraft*, *Part I — International Commercial Air Transport — Aeroplanes*, the *Procedures for Air Navigation Services — Training (Doc 9868)*, the Manual of EBT (Doc 9995) and the Manual on Aeroplane Upset Prevention and Recovery Training (Doc 10011).

Academic training. Training that places an emphasis on studying and reasoning designed to enhance knowledge levels of a particular subject, rather than to develop specific technical or practical skills.

Accountable executive. The individual who has corporate authority for ensuring that all training commitments can be financed and carried out to the standard required by the civil aviation authority (CAA), and any additional requirements defined by the approved training organization.

Aerodynamic stall. An aerodynamic loss of lift caused by exceeding the critical angle of attack (synonymous with the term “stall”).

Aeroplane upset. An airplane in flight unintentionally exceeding the parameters normally experienced in line operations or training, normally defined by the existence of at least one of the following parameters:

a) Pitch attitude greater than 25 degrees, nose up; or

b) Pitch attitude greater than 10 degrees, nose down; or

c) Bank angle greater than 45 degrees; or

d) Within the above parameters, but flying at airspeeds inappropriate for the conditions

Airmanship. The consistent application of the core competencies to accomplish flight objectives.

Angle of attack (AOA). Angle of attack is the angle between the oncoming air, or relative wind, and a defined reference line on the aeroplane or wing.

Approach-to-stall. Flight conditions bordered by stall warning and aerodynamic stall.

Assessment. The determination as to whether a candidate meets the requirements of the competency standard.

ATA Chapters. The chapter numbering system controlled and published by the Air Transport Association, which provides a common referencing standard for all commercial aircraft documentation.

Autoflight systems. The autopilot, autothrottle (or autothrust), and all related systems that perform automatic flight management and guidance.

Behavior. The way a person responds, either overtly or covertly, to a specific set of conditions, which is capable of being measured.

Behavioral indicator. An overt action performed or statement made by any flight crew member that indicates how the crew is handling the event.

Competency. A combination of skills, knowledge and attitudes required to perform a task to the prescribed standard.

Competency-based training. Training and assessment that are characterized by a performance orientation, emphasis on performance criteria and their measurement and the development of training to the specified performance standards.

Note: Competency-based training requires of a defined set of Core Competencies

Competency element. An action that constitutes a task that has a triggering event and a terminating event that clearly defines its limits, and an observable outcome.

Core competencies. A group of related behaviors, based on job requirements, which describe how to effectively perform a job. They describe what proficient performance looks like. They include the name of the competency, a description, and a list of behavioral indicators. They are the elements of successful Threat and Error Management.

Critical angle of attack. The angle of attack that produces the maximum coefficient of lift beyond which an aerodynamic stall occurs.

Critical flight maneuvers. Maneuvers that place significant demand on a proficient crew.

Critical system malfunctions. Aircraft system malfunctions that place significant demand on a proficient crew. These malfunctions should be determined in isolation from any environmental or operational context.

Cueing. Provision of sensory perception in simulation.

Destination airplane. The type of airplane intended to be operated by the MPL graduate.

Error. An action or inaction by the flight crew that leads to deviations from organizational or flight crew intentions or expectations.

Error management. The process of detecting and responding to errors with countermeasures that reduce or eliminate the consequences of errors, and mitigate the probability of further errors or undesired aircraft states.

Evidence-based training (EBT). Training and assessment that is characterized by developing and assessing the overall capability of a trainee across a range of Pilot Core Competencies rather than by measuring the performance of individual events or maneuvers.

Facilitation technique. An active training method, which uses effective questioning, listening and a non-judgmental approach and is particularly effective in developing skills and attitudes, assisting trainees to develop insight and their own solutions and resulting in better understanding, retention and commitment.

Factor. A reported condition affecting a flight, an incident or an accident.

Fidelity. Realism in simulation.

Fidelity level. The level of realism assigned to each of the defined FSTD features.

Flight crew member. A licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period.

Flight path. The trajectory or path of an object (aeroplane) travelling through the air over a given space of time.

Flight simulation training device (FSTD). A synthetic training device that is in compliance with the minimum requirements for FSTD qualification as described in Doc 9625.

Instructional systems design (ISD). A formal process for designing training which includes analysis, design and production, and evaluation phases.

Instructor. A person authorized to provide academic or practical training to a trainee or student for an aviation license, rating or endorsement.

Inter-rater reliability. The consistency or stability of scores between different raters (instructors).

Line orientated flight scenario (LOFS). LOFS refers to training and assessment involving a realistic, “real time”, full mission simulation of scenarios that are representative of line operations.

Note: Special emphasis should be given to scenarios involving a broad set of competencies that simulate the total line operational environment, for the purpose of training and assessing flight crew members.

Line-orientated flight training. Training and assessment involving a realistic, “real time”, full mission simulation of scenarios that are representative of line operations.

Maneuvers. A sequence of deliberate actions to achieve a desired flight path. Flight path control may be accomplished by a variety of means including manual aircraft control and the use of auto flight systems.

Maneuver-based training. Training that focuses on a single event or maneuver in isolation.

MPL instructor. An instructor, who has undergone a screening and selection process, successfully completed an approved course in delivering competency-based training and is subsequently authorized to conduct training within an approved MPL program.

Negative training. Training which unintentionally introduces incorrect information or invalid concepts, which could actually decrease rather than increase safety.

On-aeroplane training. A component of a UPRT program designed to develop skill sets in employing effective upset prevention and recovery strategies utilizing only capable light aeroplanes.

Outcome grading. Assessment using a grading scale with two or more grades describing the overall outcome in relation to a defined outcome (not assessing the individual competencies in depth).

Performance criteria. Simple, evaluative statements on the required outcome of the competency element and a description of the criteria used to measure whether the required level of performance has been achieved.

Phase of flight. A defined period within a flight.

Note: E.g., take-off, climb, cruise, descent, approach and landing.

Post-stall regime. Flight conditions at an angle of attack greater than the critical angle of attack.

Practical training. Describes training conducted on airplanes or FSTDs to develop the core competencies by applying knowledge, skills and attitude. It is normally preceded by academic training.

Quality. The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs.

Quality assurance (QA). All the planned and systematic actions necessary to provide adequate confidence that all training activities satisfy given standards and requirements, including the ones specified by the approved training organization in relevant manuals.

Quality management. A management approach focused on the means to achieve product or service quality objectives through the use of its four key components: quality planning; quality control; quality assurance; and quality improvement.

Quality System. The aggregate of all the organization's activities, plans, policies, processes, procedures, resources, incentives and infrastructure working in unison toward a total quality management approach. It requires an organizational construct complete with documented policies, processes, procedures and resources that underpin a commitment by all employees to achieve excellence in product and service delivery through the implementation of best practices in quality management.

Scenario. Part of a training module plan that consists of predetermined maneuvers and training events.

Scenario-based training. Training that incorporates maneuvers into real-world experiences to develop and instill the core competencies in an operational environment.

Stall. An aerodynamic loss of lift caused by exceeding the critical angle of attack

Note: A stalled condition can exist at any attitude and airspeed, and may be recognized by continuous stall warning activation accompanied by at least one of the following:

a) Buffeting, which could be heavy at times

b) Lack of pitch authority and/or roll control, and

c) Inability to arrest the descent rate

Stall warning. A natural or synthetic indication provided when approaching a stall that may include one or more of the following indications:

a) Aerodynamic buffeting (some airplanes will buffet more than others)

b) Reduced roll stability and aileron effectiveness

c) Visual or aural cues and warnings

d) Reduced elevator (pitch) authority

e) Inability to maintain altitude or arrest rate of descent; and

f) Stick shaker activation (if installed)

Note: A stall warning indicates an immediate need to reduce the angle of attack.

Startle. The initial short-term, involuntary physiological and cognitive reactions to an unexpected event that commence the normal human stress response.

Training event. Part of a training scenario that enables a set of competencies to be exercised.

Training objective. A clear statement that is comprised of three parts, i.e.:

a) The desired performance or what the trainee is expected to be able to do at the end of training (or at the end of particular stages of training); (xv) Manual on Aeroplane Upset Prevention and Recovery Training

b) The conditions under which the trainee will demonstrate competence; and

c) The performance standard to be attained to confirm the trainee's level of competence

Transport category aeroplane. A category of airworthiness applicable to large civil aeroplanes, which are either:

a) Turbojets with 10 or more seats or having a maximum take-off mass (MTOM) of greater than 5 700 kg (12 566 lb); or

b) Propeller-driven aeroplanes with greater than 19 seats or a MTOM greater than 8618 kg (19 000 lb)

Threat. Circumstances, events or errors, which increase operational complexity and must be managed to maintain the margin of safety.

Threat management. The process of detecting and responding to threats with countermeasures that reduce or eliminate the consequences of threats and mitigate the probability of errors or undesired aircraft states.

Training event. Part of a training scenario that enables a set of competencies to be exercised.

Training objective. A clear statement that is comprised of three parts, i.e.:

a) The desired performance or what the trainee is expected to be able to do at the end of training (or at the end of particular stages of training)

b) The conditions under which the trainee will demonstrate competence; and

c) The performance standard to be attained to confirm the trainee's level of competence

Underpinning knowledge. Those elements of academic knowledge that can be applied to facilitate achievement of training tasks in a particular training lesson or training segment.

Undesired aircraft state. Flight crew-induced aircraft position or speed deviations, misapplication of flight controls, or incorrect systems configuration, associated with a reduction in margins of safety.

Glossary of Abbreviations

Abbreviation	Meaning
A/C	Aircraft
AMC	Acceptable Means of Compliance
ANC	Air Navigation Commission
ATC	Air Traffic Control
ATO	Approved Training Organization
ATPL	Airline Transport Pilots License
BT	Base Training (Landing Training)
CAA	Civil Aviation Authority
CBT	Computer-Based Training
CCQ	Cross-Crew Qualification (Airbus)
CPL	Commercial Pilot License
CRM	Crew Resource Management
EASA	European Aviation Safety Agency
EBT	Evidence-Based Training
ELT	English Language Training
ELT	Entry Level Training (Airbus)
FAA	Federal Aviation Administration
FAQ	Frequently Asked Questions
FCLTP	Flight Crew Licensing and Training Panel (ICAO)
FI	Flight Instructor
FMS	Flight Management System
FNPT II	Flight Navigation Procedures Trainer II
FODA	Formative Observation Data Analysis
FOQA	Flight Operations Quality Assurance
FRMS	Fatigue Risk Management System (ICAO)
FSI	Flight Simulator Instructor
FSTD	Flight Simulation Training Device

GA	General Aviation
GM	Guidance Material
HF	Human Factors – Man and his interaction with the world around him
HT	Head of Training
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICAO Doc 9625	Manual of Criteria for the Qualification of Flight Simulation Training Devices
ICAO Doc 9868	Procedures for Air Navigation Services – Training (PANS-TRG)
ICAO Doc 9995	Manual of Evidence-based Training
ICAO Doc 10011	Manual on Aeroplane Upset Prevention and Recovery Training
ICATEE	International Committee for Aviation Training in Extended Envelopes
IEM	Interpretive and Explanatory Material (EASA)
IFALPA	International Federation of Air Line Pilot's Associations
IOS	Instructor Operating Station
IQ	Instructor Qualification (ITQI)
IFR	Instrument Flight Rules
IOE	Initial Operating Experience
IOS	Instructor Operating Station (FSTD)
IOSA	IATA Operational Safety Audit
IPPTG	International Professional Pilot Training Group
IR	Instrument Rating
IRM	Intuitive Risk Matrix (ITQI)
ISD	Instructional System Design
ISM	IOSA Standards Manual
I-STARS	Integrated Safety Trend Analysis & Reporting System (ICAO)
IT	Information Technology
ITQI	IATA Training and Qualification Initiative
IWG	International Working Group (developed ICAO Doc 9625)
JAA	Joint Aviation Authority (Europe, pre-EASA)
KSAs	Knowledge, Skills and Attitudes
LM2	Improved Lateral Motion Algorithm (FSTD)

LOC-I	Loss of Control In-flight
LOE	Line Operational Experience
LOFT	Line Oriented Flight Training
LOS	Line Operational Simulation
LOSA	Line Operations Safety Audit (ICAO Doc 9803)
LSK	Licensing Skill Test – EASA
LT	Landing Training (Base Training)
MCC	Multi-Crew Cooperation
MFF	Mixed Fleet Flying (Airbus)
MPA	Multi-Crew Aeroplane
MPL	Multi-Crew Pilot License
MPL Phase 1	Core Flying Skills Phase
MPL Phase 2	Basic Phase
MPL Phase 3	Intermediate Phase
MPL Phase 4	Advanced Phase
NAA	National Aviation Authority
NGAP	ICAO Next Generation of Aviation Professionals
NPA	Notice of Proposed Amendment (EASA)
NPRM	Notice of Proposed Rulemaking (FAA)
PANS	Procedures for Air Navigation Services
PAT	Pilot Aptitude Testing (ITQI)
PC	Personal Computer
PELT	Pilot Licensing and Training
PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
PNF	Pilot Not Flying (old expression for PM)
PPL	Private Pilot License
QA	Quality Assurance
RAeS	Royal Aeronautical Society
SARPS	Standard and Recommended Practices (ICAO)

SE (A)	Single Engine (Airplane)
SEP	Single Engine Piston
SFI	Synthetic Flight Instructor (EASA)
SMS	Safety Management System (ICAO Doc 9859)
SMM	Safety Management Manual
SOP	Standard Operation Procedure
SR	Speech Recognition
STEADES	IATA Safety Trend Evaluation, Analysis and Data Exchange System
STI	Synthetic Training Instructor
TE (A)	Twin Engine (Airplane)
TEM	Threat and Error Management (ICAO Doc 9803)
T/R	Type Rating
TRE	Type Rating Examiner (EASA)
TRG	Training
TRI	Type Rating Instructor (EASA)
TRTO	Type Rating Training Organization
UPRT	Upset Prevention and Recovery Training
UAS	Undesired Aircraft State
VFR	Visual Flight Rules

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MPL Implementation Guidance Notes

1. Manual Objective

This document consolidates available MPL guidance material into one manual to accelerate understanding, adoption and effective implementation of MPL. The content will be useful to the following entities:

1. Civil Aviation Authorities (CAAs)
2. Operators
3. Pilot Representative Bodies
4. Approved Training Organizations (ATOs)
5. MPL course developers
6. Young people interested in becoming airline pilots

2. Manual Content

The material in this manual is based on:

1. ICAO Annex 1 – *Personnel Licensing*
2. ICAO Doc 9625 Ed.3, the *Manual of Criteria for the Qualification of Flight Simulation Training Devices,* Volume 1 – *Aeroplanes*
3. ICAO Doc 9841, *the Manual on the Approval of Training Organizations,* Second Edition – 2012
4. ICAO Doc 9868, the *Procedures for Air Navigation Services – Training* (PANS-TRG), First Edition – 2006 Amdt # 3, Chapters 1, 2, 3 & 6
5. Rationales are derived from the MPL research and development process (64 participants of the ICAO Flight Crew Licensing and Training Panel [FCLTP] during MPL development (2002 to 2005 – members and observers nominated by 18 Contracting States and five international organizations)
6. European Aviation Safety Agency (EASA) Part – FCL

3. Manual Structure

The manual is structured in a logical sequence: preparatory information, crew aptitude testing, then training by MPL phases. The bulk of early sections in the manual (1 – 14) provide general preparatory guidance. Section 15 provides specific guidance according to the phases of the MPL Training Course. Section 16 provides guidance for CAAs on the approval process, and Section 17 summarizes how some major regulators of the world have transposed the ICAO MPL regulations into their own requirements. Eight Attachments provide useful reference material.

4. Terminology Used

An attempt has been made throughout the manual to use ICAO terminology wherever possible. As the industry develops, new and different terminologies emerge leading to multiple terms with the same meaning. The glossary of terms and definitions at the front of this manual provides a cross-reference of terms, for greater clarity of meaning in all regions of airline activity.

Illustrative examples:

SFI: Synthetic Flight Instructor (under EASA) = FSI: Flight Simulator Instructor or similar in other regions.

PM: Pilot Monitoring has been seen in recent years as a more appropriate descriptor than PNF (Pilot Not Flying) and adopted for some time by Airbus and Boeing. As a result, many operators already use the term PM in their operations manuals.

5. Data Sources

Data supporting this manual is derived primarily from MPL courses in operation or planned between November 2006 (MPL introduction) and May 2014. Data used to develop this Guidance Material stems from:

- ATOs which globally conduct MPL courses, through personal and telephone interviews, e-mail correspondence and structured questionnaires
- Operators that work with ATOs and that hired/will employ the successful MPL graduates
- Insights collected from the EASA, Transport Canada and Qatar CAA (QCAA) MPL Advisory Boards
- Results of an EASA MPL survey among the European Civil Aviation Authorities
- Personal discussions/interviews and e-mail correspondence with individual instructors engaged in the MPL training and assessment process
- Personal discussions/interviews and e-mail correspondence with MPL students/graduates in different stages of training
- Discussions, in person or by e-mail, with Civil Aviation Authorities representatives engaged in pilot licensing, training and testing and MPL course approval and oversight, in particular with the Singaporean CAA (CAAS) and QCAA
- Participation in Pilot Training Conferences, Workshops and Panels
- Outcomes from the ICAO MPL Symposium in Montreal in December 2013

6. Data Sample Size and Early Publication of the Manual

Although the data collected from MPL courses conducted and running up to this date is still small (approximately 2700 MPL students enrolled and 1000 MPL students graduated), when combined with

general program feedback, the output is sufficient to enable this second edition of the Implementation Guidance Material to be published. There are three compelling reasons for this:

1. The urgency for improved airline pilot training: the global civil aviation training community now accepts that the traditional, inventory and hours-based training regulations for ab-initio pilot training are out of step with the requirements of multi-crew operation in modern transport airplanes, and that multi-crew training has become a prime solution to improve safety.
2. The availability of better practice: the competency-based training approach will yield higher quality graduates more efficiently.
3. The avoidance of misunderstanding: for much of the airline training industry, competency-based training is a seismic shift in approach to training professionals. It is important that the concept is well understood at the earliest, to avoid misunderstandings.

7. Caveats

Course duration: The length of an average MPL course is approximately 18 months from start to Type Rating (inclusive). However, the restricted MPL License is not issued before successful completion of the Base Training. After successfully finishing the Initial Operating Experience (IOE) Phase the restriction will be removed from the license. The economic recession during 2010/2011 has delayed some programs mid-stream so that some course-length data to date were anomalous.

Gender: Any reference to male gender in this manual is intended to mean both male and female.

References: Although the content of this manual is referenced to official ICAO, EASA and other regulatory documents, the reader should recognize that these documents take priority over the content of this manual, some of which is inevitably subject to interpretation.

Dominant references: For each CAA, the ICAO framework provided by Documents 9868 and 9841 remain the dominant references. The more recent ICAO *Manual of Evidence-based Training* (Doc 9995), designed for airline recurrent training, also has some useful content on core competencies and safety data analysis.

8. Manual Updates

MPL requires a new training process which is evolving as a result of continuous feedback and the incorporation of new evidence, as it becomes available. IATA commits to updating this guide on a regular basis, especially when significant changes occur. As a result, the various course structures described in the Global MPL Course Tracker are likely to evolve in light of further in-service experience. The Global MPL Course Tracker is available at www.iata.org on the IATA/ITQI web page.

Section 1—The History of MPL

1.1 Legacy Process

Since 1947, traditional training for airline pilots has followed a prescriptive compartmentalized (box ticking) process along the following lines:

1. Ab-initio training in light propeller single-engine (SE) and multi-engine (ME) *aircraft (normally delivered by instructors without airline experience – and sometimes motivated to build their own hours),* graduating with a Commercial Pilot License and Instrument Rating
2. Accumulation of applicable flight experience (in countries with a ready-entry career structure such as the USA)
3. Transport category equipment upgrade
4. Airline type transition
5. Base training (BT) and Initial Operational Experience (IOE)

1.2 Factors Supporting the Need for Change

- **Human Performance.** Human performance issues have become increasingly complex and have been identified as a contributing factor in incidents and accidents.
- **Adaptation needed.** To improve the quality and relevance of airline pilot selection and training, fresh strategies are needed. Pilot Aptitude Testing (PAT) and competency-based training have been identified as being vital in supporting the airline industry's safety objectives.
- **Aircraft design.** Hardware has improved significantly, but the opportunity to further develop technology in any short time frame is limited; there is no sign yet of 5th generation airliners.
- **Expansion and safety.** There is a need to further reduce the accident rate in order to prevent the expansion of the airline industry from leading to more frequent accidents.
- **Holistic approach.** IATA is encouraging the adoption of MPL training as an important component of a "Total-Systems-Approach" to enhance safety.
- **Outdated process.** Over the past decades, ICAO training and licensing standards have remained relatively unchanged and become recognized as impediments to the application of proven industry best practices. Modern course development tools such as underpinning detailed job/task analyses and the use of Instructional Systems Design (ISD) practices need to be well understood and utilized by approving authorities and the airline training industry.
- **Updated training tools.** Flight Simulation Training Device (FSTD) technology has been revolutionized and should be used to a greater extent.

1.3 Recognition of New Training Needs

There has been an increasing awareness that new actions are needed in training:

- To re-engineer ab-initio training based on a cognitive task analysis of operational expert behavior
- To transfer to students appropriate Knowledge, Skills and Attitudes (core competencies) for safe, effective and efficient multi-crew flight operations much earlier in the ab-initio training process
- To focus on the development of multi-crew co-operation at an earlier stage in the training process
- To develop strategic thinking and decision making in parallel with technical knowledge and skills
- To gain credit for the use of advanced synthetic training tools of all levels of fidelity (FSTD)
- To counteract the increasing number of fatalities caused by LOC-I losses by including Upset Prevention and Recovery Training (UPRT)

1.4 Earlier Attempts

The need to update airline pilot training was already recognized in the 1980s. The first ICAO attempt to adapt to changes in the airline industry resulted in the creation of the Pilot Licensing and Training Panel from 1982–1986, which failed. The encouraging final proposal could not find the necessary support from the Air Navigation Commission (ANC) and the ICAO Council.

1.5 Most Recent Action – The Birth of MPL

The second attempt commenced in October 2000 in Madrid and led to the establishment of the ICAO Flight Crew Licensing and Training Panel (FCLTP) from 2002 till 2005. The FCLTP was composed of 64 participants, including members and observers nominated by 18 Contracting States and 5 international organizations. The ANC adopted the FCLTP's recommendations, which led to a new edition of Annex 1 containing the MPL provisions in Chapter 2.5 and a new PANS-TRG (ICAO Doc. 9868), published in November 2006. The transposition into the European Joint Aviation Regulations (JARs) took place in parallel, and in December 2006 the new JAR-FCL Amendment # 7, including MPL, was published. Since 8 April 2012, the MPL has been regulated by EASA Part-FCL, but the vast majority of the 31 States under EASA made use of a derogation option and only applied Part-FCL on 8 April 2013.

By May 2014, 52 States had adopted MPL regulations and MPL courses were being conducted in 17 States.

1.6 Current Development

With a better understanding of MPL, a new climate has emerged. There has been a progressive increase in awareness of MPL in 2012 and 2013, and the current substantial growth rates of global civil aviation, with the subsequent need for better trained pilots, could augment the global implementation of MPL. Ultimately, MPL training could become a preferred ab-initio route to an airliner cockpit. (*Attachment 1 – Global Status of MPL Implementation* – provides additional information regarding existing MPL programs/approvals.)

Section 2—The Potential Benefits of the MPL

2.1 Multi-Crew Focus

The MPL is a state-of-the-art ab-initio airline pilot training program, seamlessly integrated with an airline type rating, with continuous multi-crew focus. The objective is to “begin with the end in mind”: the qualified airline First Officer – operations-ready, with the ultimate goal to become a Captain after fulfilling the respective regulatory and company requirements.

2.2 A Dynamic Process

MPL training is dynamic, rather than hours-prescriptive (the traditional ab-initio CPL training approach). MPL recognizes that flying hours in isolation are experienced and applied in many ways, and are not a guarantee of competency.

2.2.1 Flexibility and Performance-Based Design

MPL is a more flexible framework designed to respond to industry performance feedback through a philosophy of continuous improvement. Being driven by the continuous assessment of student performance, measured against expected standards of performance, is a major advantage of MPL training.

2.3 Removal of Legacy Regulatory Hurdles

MPL removes many of the regulatory impediments prescribed for the more traditional flight training programs and enables best industry practices through the application of modern Instructional Systems Design (ISD) approaches, and the effective use of Learning Management Systems (LMS).

2.4 Variability of Early Courses

As the Global MPL Course Tracker (available on the IATA website, www.iata.org) indicates, current MPL courses are of varying lengths- some shorter and some longer than traditional ab-initio training programs. Early courses are unlikely to be less expensive, and may indeed be slightly more expensive than traditional training due to the re-engineering of training resources. Convergence in program optimization and standardization will occur as experience is gained.

2.5 Competencies of the Airline Pilot's Job

MPL is based on training and applying the pilot core competencies required to operate modern transport category airplanes safely, efficiently and effectively, in all regimes of a flight in normal and abnormal situations. It applies whether the pilot functions as a Co-pilot in the beginning, or eventually as a Captain.

2.6 Longer Term Cost Savings

The underlying goal is to provide the MPL graduate with more relevant and higher quality training for airline operations, which will eventually translate into greater operational safety and efficiency.

2.7 Unintentional Consequences

Although there are some clear benefits resulting from a strong link between an MPL program and a single sponsoring airline; regulators and airlines should be aware that it is not the intention of the MPL structure to create a situation where students or graduates, whose ability to exercise the privileges of their license is restricted to a single operator, results in them being:

- Liable for the costs of training without an ability to use their license to access employment in order to cover those costs
- In a situation of dependency with a single operator such that their free participation in a just aviation safety culture is impeded; or that they are unable to exercise free movement in their work at the earliest reasonable opportunity

It is therefore incumbent on operators and regulators to guard against such risks.

2.8 Embedded Human Factor Skills Training

Many incidents and accidents in civil aviation are caused by human performance deficiencies such as a lack of interpersonal skills (communication, leadership and teamwork, workload management, situation awareness, and structured planning and decision making). MPL requires full-time embedded (rather than add-on) Crew Resource Management (CRM) and Threat and Error Management (TEM) training.

2.9 New Training Tools

MPL demands that training device criteria and the selection of courseware be driven by training objectives (rather than the other way around). The latest developments in Flight Simulation Training Devices (FSTDs) qualification criteria are found in ICAO Doc 9625 Ed. 3, published in 2009, as amended, which are the result of many years of international refinement.

Competency-based training also demands that the progression of each student is effectively monitored through the use of a robust Learning Management Systems (LMS). This ensures that the timely and

continuous remediation of student performance deficiencies, from the expected standard, takes place throughout the training program.

2.10 Simulated ATC Environment

(See Section 14 of this manual).

2.11 Upset Prevention and Recovery Training (UPRT) and Automation Management

To address on-going Loss of Control (LOC) threats in airline operations, MPL mandates that upset prevention and recovery training (UPRT), in both aircraft and FSTDs, is delivered by appropriately qualified instructors. MPL also considers and addresses threats inherent from increased automation and reduced manual flying (see Section 11).

Summary

MPL is an integrated ab-initio program:

- Determinedly designed for multi-crew airline operations, with quality, relevance and safety in mind
- Competency-based, using pilot core competencies established through task analysis, and applied through instructional systems design and the effective use of learning management systems
- Containing a set of modern airline training requirements that include:
  - Greater emphasis on flight simulation in a multi-crew environment than on single pilot environment in light training aircraft
  - Embedded CRM/multi-crew concept and TEM throughout
  - Mandatory upset prevention and recovery training
  - Simulated ATC environment in FSTD training (in progress)

Section 3—Cooperation between Operator, ATO and Civil Aviation Authority (CAA)

3.1 Early Assumption

During the development of the MPL there was an initial assumption that MPL courses would mainly be of interest to well-established operators, who run their own “cadet” training programs utilizing in-house flight training facilities. This assumption has been reviewed for several reasons.

3.2 Outsourced ATOs

Many operators have traditionally outsourced their cadet training, mainly for economic reasons, to Approved Training Organizations (ATOs) as third-party training providers. An increasing number of independent ATOs recognize that close connections to potential employers support training quality, attract more cadets (most attractive is the inclusion of IOE), and are therefore beneficial to their business. Outsourcing arrangements, especially if they involve several different agencies, can become quite complex for some CAAs and is addressed in Section 16 of this guide.

Note: The general qualification requirements for ATOs can be found in ICAO Annex 1, Appendix 2 “Approved Training Organizations”. These requirements are more detailed in ICAO Doc 9841 “Manual on the Approval of Training Organizations” Second Edition - 2012 (See www.icao.int).

3.3 Initial Setup for MPL Program

The initial setup of an MPL course requires a great amount of management attention and documentation. The following steps are needed:

1. Involve both the Licensing Authority and, perhaps, the air operator certificate Issuing Authority from the outset, as subsequent steps will require both of their inputs and approval.
2. Set up the cooperation framework between operator and ATO(s).
3. Establish administrative processes and timelines.
4. Ensure the development and the delivery of the entire proposed training program is captured within a quality assurance system(s), Appendix B to ICAO Doc 9841 refers.

3.4 Considerations for the Civil Aviation Authority

3.4.1 Preface

Some Civil Aviation Authorities have progressed with MPL regulations with parameters that exceed those stipulated under ICAO PANS-TRG. Based on local needs, it is the responsibility of the CAA to stipulate requirements based on the ICAO Annex1 and PANS-TRG.

3.4.2 Link between Operator and ATO(s)

MPL regulations strongly suggest, and some major CAAs even mandate, that the operator and the partnering ATO(s) be contractually connected. Such cooperation improves the overall effectiveness of a competency-based training system and is therefore viewed as a sensible prerequisite for course approval.

3.4.3 Common Frameworks between Stakeholders of MPL Programs

Options are, but may not be limited to:

a) The operator contracts the appropriate ATO to deliver Phases 1, 2, and 3 and the operator conducts Phase 4 in its training center, BT and IOE.

b) The operator contracts the ATO to deliver Phases 1 and 2 and the operator conducts Phases 3 and 4 in its training center, BT and IOE.

c) The operator owns appropriate ATO(s) and manages the complete MPL program under its own authorizations.

3.4.4 Assumed Responsibility / Accountability

Regardless of which option is adopted, one single person/office should be responsible for the regulatory compliance of the entire training program, particularly in the instance of multiple ATOs providing specific phases of the training. It is strongly recommended not to put the program standards at risk by devolving accountabilities between Heads of Training. To ensure high program fidelity and standards of delivery, the overall responsibility should lie with the accountable executive of the corporate entity that is deemed to hold the proprietary rights to the training program and holds the approval for it.

For practical purposes, the Approving Authority may permit the transfer of this responsibility for program regulatory compliance to the accountable executive of the “partnering” airline, under tightly controlled conditions, once base training and IOE are ready to commence.

3.5 Specific Issues

3.5.1 Base Training (BT)

For BT, ICAO Annex 1 would allow the holder of a student pilot license to be trained by a qualified instructor. Under some existing national regulatory structures, Base Training (BT) on a Multi-Pilot Aeroplane (MPA) can only be performed by a traditionally licensed crew. For this reason, MPL cadets may be expected to possess a document or license that entitles them to conduct the Base Training (BT) with a TRI. In such a case, options to consider with the regulator may include:

a) As a legacy process, some regulators accept a PPL as “legal documentation” to permit BT on the MPA. MPL students could be issued with a PPL during the course to permit BT *[the logic of requiring a PPL for BT may require review. Under ICAO MPL SARPS the issue of a PPL is not required and interferes with the MPL syllabus]*.

b) Until regulatory structures are updated to recognize the full value of the MPL, the regulator may grant a local exemption from traditional “licensing” requirements for BT, recognizing that the MPL is a fully integrated program aimed at acquiring and applying the pilot core competencies to safely, efficiently, and effectively act as First Officer in transport category airplane line operations.

c) Some regulators may elect to revise existing regulations to allow all MPL training prior to IOE to be accomplished under a student pilot license (this would be a nationally recognized license under ICAO Annex 1).

d) The regulator may decide to issue a restricted MPL after the successful completion of the MPL/Type Rating FSTD check (similar to the traditional CPL scenario, where the CPL comes before the airline type transition, BT and IOE).

3.5.2 License during IOE Phase

A license is required before commencement of IOE in commercial operations. The Authority may issue an MPL or an MPL with a restriction (only valid for flights with XYZ-Operator). After the successful completion of the IOE phase the restriction will be removed.

Section 4—Competency-Based Training and Assessment

4.1 Characteristics of Competency-Based Training

4.1.1 Outcome-Based Approach

Competency-based training focuses on the training outcome rather than the amount of training time. Training hours are replaced by defined performance criteria translated into measurable behavioral indicators. The design of a competency-based training course therefore requires a thorough understanding by all stakeholders, especially the course designers, of the required attributes of such a highly-specialized approach to training. (*Appendix E to ICAO Doc 9841 refers*).

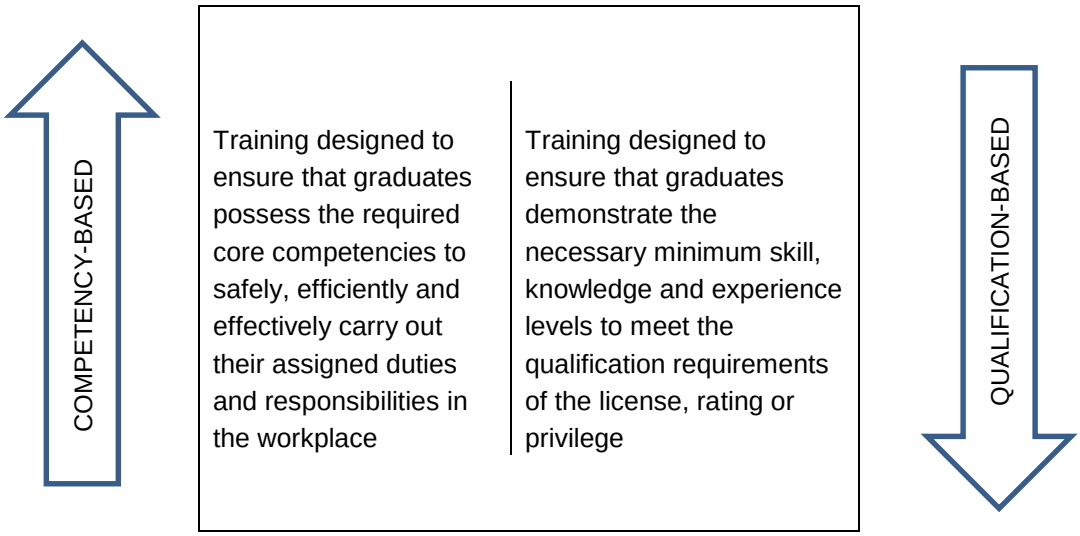


Figure 1. Competency-Based Training versus Qualification-Based Training

Except for the overall number of hours (minimum 240) and a minimum of hours during core flying skills training (at least the requirements for PPL), MPL competency-based training does not otherwise "prescribe" training hours. Requirements for accumulated hours are of secondary importance.

MPL training requires the establishment of a well-defined set of core competencies. Operators and ATOs are encouraged to develop, retain or improve their own competency assessment system.

All core competencies are applicable to single pilot and multi-crew operations. They can serve as: selection criteria during pilot aptitude testing; they are the competencies to be developed during ab-initio training; they can be taken to an operational level during type rating and initial line training; and they are required during evidence-based recurrent training. Finally, the core competencies can serve as measurement criteria for instructor and evaluator selection and qualification.

An example set of eight Core Competencies can be found in ICAO Doc 9995, Appendix 1.

Note: Refer to Attachment 3 for the EBT Core Competencies.

4.1.2 What is Competency-Based Training?

MPL courses require a competency-based approach to training program design and delivery. ICAO has defined competency-based training and assessment as*: "training and assessment that are characterized by a performance orientation, emphasis on standards of performance and their measurement, and the development of training to the specified performance standards".* It also clarifies the term "competency" to mean *"the combination of Knowledge, Skills and Attitudes (KSAs) required to performing a task to a prescribed standard under a certain condition".*

Competency-based training is not a new concept. However, for much of the airline industry the application of a competency-based approach has posed a significant challenge, particularly for organizations planning MPL training. Most ATOs or airlines have never before engaged in either the development or delivery of a competency-based course. Even more significant, many CAAs have little or no experience providing the required regulatory structures and oversight for a competency-based program (this is discussed in detail in Section 16).

4.1.3 Rationale for Competency-Based Training

Aircraft design and reliability have improved steadily and significantly over time, yet accidents still occur even though the aircraft and systems were often operating without malfunction.

It is impossible to foresee all possible accident scenarios given today's flight deck complexity and integration of automated systems. This makes it hard for designers to predict all failure and partial-failure modes, which means the next accident may be something completely unexpected. Competency-based training addresses this by moving from pure manoeuver or scenario-based training, to prioritizing the development and assessment of defined core competencies and their respective behavior indicators.

Implementation of competency-based training involves a paradigm shift. It does not simply replace a sometimes outdated set of critical events with a new set, but uses events as a vehicle to develop and assess crew performance against a range of defined core competencies. In addition, it refocuses the instructor onto analyzing the root causes of unsuccessfully performed maneuvers in order to correct inappropriate actions, rather than having the student repeat the maneuvers with no real understanding as to why it was not successfully executed in the first instance.

Having the ability to accurately apply the principles of "fault analysis" should be a major determinant in the selection process of instructors who will be expected to conduct a competency-based training program such as MPL. The labeling of knowledge and skills into "technical" and "non-technical" categories is an unnecessary complication. Safe and efficient operations require an appropriate blend of both technical and non-technical areas. An example of core competencies can be found in Appendix 1 of ICAO Doc 9995, *Manual of Evidence-based Training*, which has been developed for operator recurrent training.

Core competencies encompass what were previously termed technical and non-technical skills, aligning the training content with the competencies necessary in a contemporary aviation context. These core competencies are also embedded in the threat and error management concept as an enhanced set of countermeasures.

Competency-based training recognizes the need to develop and assess both individual and crew performance levels according to a defined set of core competencies. It includes the previous set of “non-technical” and “technical” skills needed to operate their equipment safely, efficiently and effectively under all possible conditions.

4.1.4 Relation between Annex 1 MPL Competencies and the Core Competencies

Note: Under the auspices of ICAO, an expert group is tasked to define and harmonize the PANS-TRG definitions and concept related to competencies for personnel requiring a license under ICAO Annex 1 and other aviation personnel. The expected completion date of this project is late 2015.

4.1.5 ICAO Definition of Core Competencies

A group of related behaviors, based on job requirements, which describe how to operate modern multi-crew transport airplane safely, effectively and efficiently. They describe what proficient performance in all phases of flight operation looks like. They include the name of the competency, a description, and a list of behavioral indicators.

The MPL competencies are listed in Annex 1, but a more pragmatic approach would be to adapt them to an example set of core competencies as described in the following paragraphs.

The MPL competencies in Annex 1 are considered to meet the objective when the trainee effectively applies the core competencies during the performance of:

1. Threat and error management (TEM) principles application
2. Aeroplane ground operations
3. Take-off
4. Climb
5. Cruise
6. Descent
7. Approach
8. Landing; and
9. After-landing and aeroplane post-flight operations

A competency-based system in operation can perhaps be more easily understood using the following "Input – Output Model".

4.1.6 Input – Output Model

a) **Individual and Crew "*input*" is measurable:**

Input refers to the question of "how" a certain output can be assured or "why" the crew was able to successfully manage the flight. This is where the paradigm shift of modern training comes into effect. Contrary to pure traditional measurement of flight parameters to a prescribed minimum standard, the attention is shifted to measuring "how effectively" the core competencies are applied. The underlying assumption is that effective application of all of the required competencies (input) will result in satisfactory aircraft handling in all flight phases ("output"). In training this means that events and scenarios are used as vehicles to develop the safe, effective and efficient application of the core competencies.

b) **Individual and Crew "*output*" is measurable:**

Output addresses the question of "what" is to be achieved. The output consists of the safe maneuvering throughout all phases of flight including handling of special events like Traffic Collision Avoidance System (TCAS), Ground Proximity Warning System (GPWS), Windshear, etc.

Note: The Annex 1 competency unit "Apply TEM principles" is assessed as an integral part of each of the other 8 phase-of-flight competency units of Annex 1 (forming the Output in the Input-Output model).

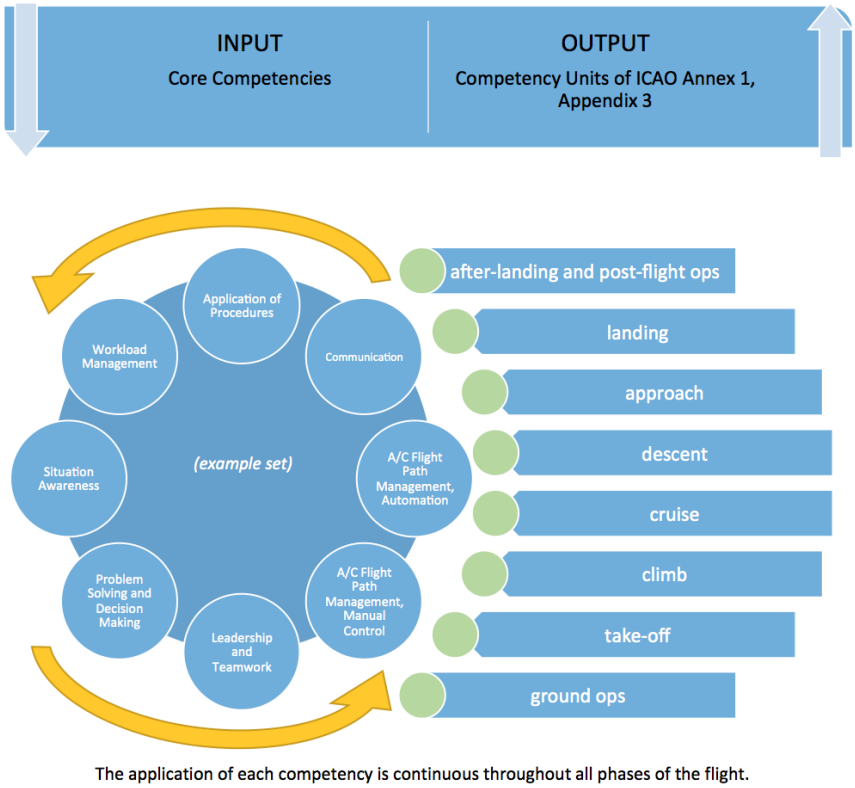


Figure 2. The Input - Ouput Model

Source: IFALPA

4.1.7 The Paradigm Shift

In competency-based training, performance is measured by how the core competencies are applied, which vary in sequence and weighting from one task to another.

4.1.8 Measurement of Competencies

In practical terms, competency-based training requires the result of training (level of competencies to be achieved) to be continuously measured. Measurement is necessary to determine if the desired level of a competency has been reached or more training is required.

4.2 The MPL Grading System – Performance Assessment

4.2.1 Desired Level of Competency / NORM

The desired level of competency is referred to as the NORM. In each lesson the achieved level of competency is measured and compared to the desired level of competency. If the achieved level matches the NORM, the student´s performance is considered to be “normal”. As a result, a student is allowed to progress within certain tolerances from one lesson to another whenever he/she has reached the required level of competency. If this continuous process of assessing performance functions correctly, further testing (such as “final checks”) may one day be obsolete.

4.2.2 System Tracking

In keeping with the tenets of effective quality assurance practices, a systematic approach to continuously monitoring both individual and overall course progression must be applied during the delivery of a competency-based program. The overriding objective of this methodology is to implement effective and timely remediation to situations whenever demonstrated performance levels are less than the identified desired standard. Failings in this area are indicative of a dysfunctional quality assurance program and a good guarantor of personnel/organizations not achieving their performance objectives.

The use of a robust Learning Management System (LMS) will go a long way to helping accomplish effective tracking processes. (*Appendix E to ICAO Doc 9841 refers*).

4.2.3 Grading-System / Performance Measurement

The behavioral indicators of each of the core competency categories express the knowledge, skills and attitude (KSAs) associated with the competency and serve as measurable performance to be compared with a *NORM*. The grading system measures the performance levels to which the KSAs are being applied to

execute the required task under the given condition. Thus, it measures the level of competency achieved. The system may describe numerical values with precise word-pictures / expressions (descriptors).

The measurement system should be student-focused. Student-focused grading systems support the student by providing helpful descriptors about his/her level of performance (i.e., “You are presently able to describe or apply or practice or consolidate or master your task ... ”).

4.2.4 Analysis

The grades collected are compared to the predefined NORM which has to be developed by the training program design team as part of the ISD process. The achieved result informs the student/ATO/operator whether the student´s performance and progression are “normal” or not.

Comparison between the actual results of the class and the NORM tells the operator/ATO whether the program NORM or the course itself needs to be reviewed.

4.2.5 Example of a Grading System

The table below shows one solution for a grading system. It uses grades 1-5 and the grades are compared with a NORM to support continuous assessment.

This grade sheet can be used for any lesson in the course. The grades 1-5 are samples only. Operators and ATOs are encouraged to use their existing grades. In order to reduce instructor workload and to simplify data collection, there is no need to insert a grade if the performance of the student was consistent with the given *NORM*. In the event the performance deviated from the *NORM*, the instructor enters a grade and by doing so he indicates where the deviation occurred and to what extent.

Core Competencies	**Flight Phases / Tasks**							
	GND	**T/O**	**CLB**	**CRUISE**	**DESC**	**APCH**	**LDG**	**GND**
Application of procedures (APP)								
Communication (COM)								
Aircraft Flight Path Management, manual control (AFM manual)		**1**	**1**				**5**	
Aircraft Flight Path Management, automation (AFM auto)								
Leadership and Teamwork (LTW)								
Problem Solving and Decision Making (PDM)								
Situation Awareness (SAW)		**1**	**1**				**5**	
Workload Management (WLM)								
Norm	**1**	**3**	**3**	**5**	**4**	**4**	**3**	**5**

The example above could reflect a lesson in which the Airplane Flight Path Management, manual control was below the NORM during T/O and CLB, but was excellent during LDG. In both cases Situation Awareness was a contributing factor.

4.3 Data Management for MPL Courses

Competency-based training and course evaluation require professional data management. Data from the grading system must be stored in an appropriate database. Analysis of these data and comparison of the grades against the NORM form the basis for further development of the course, plus selection enhancement. This is a joint operator-ATO-Pilot Aptitude Testing (PAT) team task (Section 5 refers). Operators normally lead this process and PAT providers / ATOs should adapt their systems in accordance with the quality system of the operator through a continuous feedback loop.

This requires the existence of a continuous two-way data feedback mechanism between the operator and the partnering ATO.

Note: Regulators should be provided with access to such data.

4.3.1 The Core Competencies and Threat and Error Management (TEM)

In the context of TEM the eight core competencies (CC) and their respective behavioral indicators constitute the countermeasures that the crew applies during all phases of flight to recognize and manage threats, errors and undesired aircraft states.

4.3.2 Value of a Globally Harmonized Competency-Based Training System

The core competencies, whether from the example set in the table in Attachment 3 or developed by the operator or ATO, can be considered state-of-the-art for use in MPL training. In addition, the availability of a worldwide harmonized set would be of great value. It would support operation, training, checking and innovation, and feed back into selection (PAT).

Core competencies (CCs) are the bedrock for globally harmonized pilot qualification requirements.

4.3.3 Data Comparison

Operators applying the same CCs can gather and share experience based on a standardized system, and design their training accordingly. The CCs also serve as measurement criteria for crew performance in both training and competency assessments. Grading systems in MPL courses measure the extent to which the crew is able to apply the CCs in the right prioritization and weighting in order to successfully manage the flight.

4.3.4 Different Systems Not a Problem, as Long as the Principle Is Retained

While legacy carriers have developed their own competency systems over recent years and are, in some cases, committed to tailored data collection and analysis systems in the process, the example set of CCs can be seen as “average” and “acceptable” to the airline industry overall.

4.3.5 Translations of Competencies into a Global Standard

Pilot core competencies worldwide are not hugely different, as the competencies required to operate an airliner safely are largely the same, regardless of crew origin. While exact wordings may differ, over time it will be possible to translate individual airline competencies (which differ slightly), into the exact meaning of the example set of CCs used in this document. That example set of CCs is being validated and refined through the work currently in progress at ICAO to update the concept of competencies. The outcome of this work is planned to be included, as modified by the validation and approval process, into ICAO PANS-TRG (Doc 9868).

4.3.6 ITQI – a New Safety Tool

Performance data collection and translation (into a common competency format) will lead to a common elevated standard of global training practices, linked to actual operational performance. This will be of immense value to the airline industry. Over the past decade, the IATA Operational Safety Audit (IOSA) has demonstrated how a common approach to airline safety standards can deliver safety dividends to the travelling public. With this document, ITQI’s MPL Training initiative seeks to similarly use a common approach to harmonize and improve MPL training standards.

4.3.7 IATA’s Total Systems Approach

The Total Systems Approach improves operational safety by using one single set of core competencies for:

- Pilot aptitude testing
- MPL training and assessment
- Type rating training
- Recurrent training
- Instructor selection and qualification

Section 5—Pilot Screening and Selection

The overriding objective of an effective screening and selection process is to ensure the recruiting organization retains only those individuals most likely to succeed in the workplace and who are capable of enhancing the value of services and/or products offered by their employer.

5.1 Part I – Pilot Aptitude Testing (PAT)

5.1.1 General

PAT is the first module of the IATA Training and Qualification Initiative (ITQI), which follows the commonly called “Total Systems Approach”. It represents the first step in the career of a pilot.

PAT should be performed before the start of MPL courses. In the case of MPL under many regulations and in conformance with ICAO PANS-TRG, the partnering operators commit themselves to provide Initial Operator Experience to the contracted graduates. This means that the MPL graduates will immediately fly in the operator’s route network in revenue service once they have been issued their MPL, without requiring any “bridge” training. Evidently, only pilot applicants who have performed well during a rigorous testing process should be admitted to an MPL program.

5.1.2 Benefits

Effective PAT can produce significant savings for the ATO and operator over time. Benefits of an effective aptitude testing include enhanced safety, lower overall training costs, higher training success rates, a more positive working environment and fairness toward the applicant. Effective aptitude testing saves money. The costs associated with implementing a functional aptitude testing system are significantly lower than the costs of subsequent high failure rates during training of inadequately tested applicants. (*Attachment 6 – IATA Guidance Material and Best Practices for Pilot Aptitude Testing* – provides the Executive Summary of the PAT Manual).

5.1.3 Early Intervention

More effective Pilot Aptitude Testing will significantly reduce subsequent failure rates in training and associated downstream costs once the graduates enter the workforce. It is by far the most efficient and effective means to ensure successful training and the availability of competent flight crews.

5.1.4 Recruiting Challenges

The next generation of student pilots may need aptitude testing and training strategies adapted for new expectations and the effects of “information overload” in their early years.

Effective pilot aptitude testing faces many new challenges today. Applicants from the new IT- generation exhibit new thinking and expectations in our world of rapid communications, which continues to evolve exponentially. Dependencies have developed for instant access to information rather than sole reliance on archived details.

5.1.5 Interest and Motivation

Different motivation levels of today’s youth necessitate a serious and continuous review of the Pilot Aptitude Testing processes. This has been influenced, in part, by very high pre-qualification training costs and generally poor salary scales for entry-level airline pilot positions. This is now well recognized by IATA, ICAO and IFALPA. Excellent tools now exist to pre-assess motivation, and this should be an early consideration in any PAT process.

5.1.6 Investments in Recruitment

It is a common error to focus on stringent testing procedures and to underestimate the importance of recruitment campaigns to attract sufficient numbers of applicants. Without sufficient applicants PAT is pointless. All stakeholders need to work toward more pre-education in schools and universities to attract fresh interest in piloting careers, particularly as the industry will need close to 500,000 new pilots over the next two decades (according to the 2014 Boeing forecast for commercial pilots). A transfer of training costs away from students to airlines may also become a necessary strategy as demand and costs increase and the applicant pool shrinks.

5.1.7 Continuous Assessment during the MPL Course

Competency-based training includes continuous assessment of performance during the course, on the assumption that the cadets are able to follow the course within tolerable variances. This quality assurance process must not be confused with screening or selection. Unlike what is practiced in some modern air forces, there is consensus industry-wide that grading or assessment during training must not be used for screening and selection purposes or as an adjunct to such processes. Rigorous screening and selection must be performed before the course commences.

5.2 The Operator in the PAT Process

In most cases, aptitude testing will be performed under the supervision of the operator who will have developed a requirement profile for First Officers, including their potential to eventually become Captains. Aptitude Tests would follow this profile. In many instances, this process includes contracted training provider(s) and companies that specialize in Aptitude Testing of potential applicants.

5.2.1 Performance Feedback

Performance data from IOE training must be fed back to the Aptitude Testing System in order to continuously validate and improve the required profile. The continuation of this process through the transition of the pilot to a Captain's position will provide good data for continuous improvement of the Aptitude Testing process, the MPL program performance, and potentially even the airline's transition training to Captain. Over time this assures the operator will eventually receive exactly the desired quality of entry-level staff.

5.2.2 System Components

The pillars of a functioning PAT system are a multi-stage testing system (less expensive screening procedures first, costly selection procedures last), a well-designed "test battery" (set of tests) and a "PAT-team" to run the system.

5.2.3 Aptitude

Testing aptitude should include basic abilities (intelligence), operational competencies, social competencies, personality traits and motivation. Motivation will drive performance in both training and operations.

5.2.4 Testing Instruments

The least qualified instruments are freestyle interviews, while the highest qualified testing instruments are psychometric testing apparatus. Specifically programed (PC-based) low fidelity simulators are best to test operational competencies, since these will provide highest values of predictive validity.

From a diagnostic point of view, work samples (simulator-assessments for pre-qualified pilots) in full-flight simulators are quite demanding (standardization of the scenarios, management of disturbances, quality of observation, complexity of facilitation, inter-rater reliability, etc.). Simple arrangements frequently do not produce the kind and quality of data required for valid aptitude testing purposes and should not be used to replace classic means of aptitude testing.

5.2.5 The PAT-Team

The design phase of an aptitude testing system should be well-structured and comprehensive, including: definition of job requirements, application/re-application criteria, presentation of results, evaluation procedures, hiring decision. The involvement of an aviation psychologist is strongly recommended as well as having qualified and experienced Captains or First Officers included on the PAT-team. Operators unfamiliar with Aptitude Testing should contract a reputable firm experienced in employment screening processes for highly-technical career positions.

5.2.6 Part of Operator Quality System

A PAT system should be part of the quality system of the operator and needs to be evaluated at regular intervals. Evaluation of the PAT system addresses the question of validity (whether or not the system measures/delivers what it is intended to measure). This process requires feedback from the operator (in case of MPL, IOE results, and later LOSA/ FDA data, line checks, proficiency checks, training reports and other reporting systems) and should be well-coordinated.

5.2.7 Direct Entry Versus Ab-Initio Entry

As the availability of direct entry (previous experience) pilots declines, the industry will become more dependent on ab-initio entry to airlines, and some operators who have been testing and hiring exclusively ready/direct entry pilots in the past may soon start taking in ab-initio pilots. This process will bring a number of challenges, including a reduction in experience levels on flight decks.

It should be recognized that such change substantially affects the company culture and may require a significant adaptation by the operator. Ab-initio pilots form a younger group within the operator's work force and will most likely identify themselves to a higher extent with the company. Attitudes toward many issues will differ from those of ready/direct entry pilots.

5.2.8 Further PAT Guidance from IATA

Comprehensive information about Pilot Aptitude Testing is available in the complimentary *IATA Guidance Material and Best Practices for Pilot Aptitude Testing*, commonly called "PAT Manual". The PAT Manual is available for free download on the IATA website. Its purpose is to enable aviation managers to compare and discuss the characteristic strengths and weaknesses of available aptitude testing systems with aviation psychologists and test providers, and to collaboratively develop a suitable solution for their company. The aim is to provide a hands-on document useable by all, which eliminates confusion from varying terminology and perceptions within the industry.

The IATA PAT Manual provides an overview of all areas of aptitude diagnostics which include both the screening and the selection process.

5.3 Part II – Aviation English Language Abilities

5.3.1 Non-Native English Speaking Students

From MPL providers to non-native English speaking students there is a clear advantage to train in an English speaking environment - to “force English speech”, embed a more international culture, and rapidly improve English language proficiency. This is generally achieved at an ATO abroad in an English speaking country, but the option also exists to set up an ATO in the students’ country of origin, with English as the mandated medium of instruction and study, and in the student hostel within the facility.

5.3.2 Pre-ATO Education

For English language development in non-English countries, colleges and universities that feed into an ATO can be encouraged to accelerate ICAO English language acquisition while students are still studying in these establishments. This objective can be enhanced in a classroom setting using PC-based ATC speech recognition systems. Aptitude testing of potential students can be conducted for the operator and ATO one year before university graduation.

5.3.3 Technical Vocabulary

Past proof of concept trials of MPL programs have indicated that non-native English speaking students often have some basic skills in the English language but frequently lack the ability to effectively communicate beyond the exchange of generalities. The fact that aviation is an extremely complex subject requires that these students be capable of grasping technical concepts and understanding complex subject material delivered in a foreign language from the outset of a course. Failure to adequately prepare these students for the rigors of training in an English language environment has resulted in enormous program cost overruns and higher than expected attrition rates.

Potential trainees should be assessed on their ability to effectively communicate in the English language on subject material that is technical in nature prior to admission into the MPL program. Based upon that assessment, if the candidate’s skill level is deemed to be acceptable to commence training, ATOs would be best served by integrating English language enhancement training into the program’s syllabus. Some MPL programs include an aviation-specific technical vocabulary syllabus in their ISD course development and delivery process. This has resulted in the design of very effective PC-based home study modules that are linked to the next day’s training events.

5.4 Part III – Air Operator Suitability

5.4.1 Airline Culture

Each airline has a distinct culture that is underpinned by the values and priorities of the organization. These two factors serve to define the employer's expectations in regard to the delivery of the company's products and services, and the desired attributes sought from each prospective employee. As a general rule, the characteristics of a safe and effective professional pilot are practically universal. However, in order to ensure a good match with the partnering airline, pilot selection and screening processes must be cognizant of the need to detect the existence of the personality traits that may be incompatible with the host organization's culture.

Section 6—Threat and Error Management

6.1 Threat and Error Management (TEM)

TEM is a model derived from a decade of analysis at the NASA / FAA Crew Research unit of the University of Texas. The model has been built from a large database, providing an important tool to help pilots identify and manage threats (hazards) and errors during flight. TEM is based on the fact that we are surrounded by threats and make errors that sometimes lead to undesired aircraft states.

The main advantage of TEM is that it places human factor aspects into an operational context. Initially designed only as a component of line operational safety auditing (LOSA), the high value of TEM for training was recognized during the development of MPL and EBT. In addition to maneuver-based training, effective TEM training introduces realistic scenarios requiring analytical thought as well as quick and effective defensive strategies, each of which are designed to enhance pilot development. Therefore, TEM should be applied from the very first lesson onwards during MPL training courses.

6.2 Embedded TEM in MPL

To highlight its special importance, PANS-TRG applies TEM to all pilot competencies. It overarches all crew activities. Some training organizations have tried to accommodate TEM requirements via short one-off “add-on” modules [TEM course complete = box ticked!], but TEM should be embedded continuously in the training process. Under ICAO ANNEX 1, Threat and Error Management (TEM) is **not only** required in the multi-crew pilot licenses but in all other licenses as well.

6.3 Still New

Although already introduced in the ICAO Human Factors Training Manual (1998), the use of TEM in training is still new for many organizations and time is needed to explain and understand the relationship between CRM and TEM. PANS-TRG can be used to understand in detail how TEM functions. CRM is not replaced by TEM; CRM is a management component of TEM.

6.4 Important Considerations Regarding TEM

- TEM is a state-of-the-art safety concept of paramount importance and must be embedded throughout the entire MPL program.
- TEM plays an important role in the process of transforming a novice (ab-initio student) into an expert airline pilot.

- TEM can be understood by students at a very early stage and practiced throughout the course with increasing success.
- TEM helps instructors transfer their experience to the students.
- TEM is independent from the use of training devices; it can be applied in aircraft and FSTDs.
- TEM pervades the entire span of a flight, including pre-flight and post-flight activities.
- Implementing TEM into everyday training creates innumerable opportunities for students to search out, recognize, and manage safety issues in a professional / structured way. They are able to progress from simple problem solving to strategic decision making and flight management.

6.5 The Link between TEM and Core Competencies

TEM stands for recognition and management of threats, errors and undesired aircraft states through the application of countermeasures. This means that countermeasures are the tools needed to enhance safety levels. Training crews with modern techniques includes educating them about countermeasures to achieve and maintain high levels of safety. Using the core competencies and their respective behavioral indicators provides a means to assess the application of TEM principles.

See Attachment 3 *Core Competencies*, from ICAO Doc 9995 (*Manual of EBT*), which offers an example set of eight core competencies. This set of competencies can be used throughout the aviation community; however operators are also free to use their own set of competencies.

Section 7—MPL Course Design

7.1 Flexibility and Innovation

The flexibility allowed in MPL, through the limiting of prescriptive parameters, constitutes one of its greatest advantages when compared to traditional types of ab-initio training courses. This broad platform allows for on-going innovation in the development and improvement of pilot training.

7.2 Operators' Commitment

Successful MPL course delivery is contingent upon the commitment of the operator's management team to invest resources in the course's final design and approval, together with the partnering ATO. Particular attention needs to be placed on the availability of appropriately qualified instructors to train the MPL students. In this regard, close collaboration with the ATO is essential to ensure each designated instructor receives the necessary exposure to the carrier's operation and culture to effectively deliver the MPL training.

7.3 Procedures for Air Navigation Services — Training (PANS-TRG)

ICAO PANS-TRG (Doc 9868, 1st Edition, Amendment 3) specifies, in greater detail than in the Standards and Recommended Practices (SARPs), the procedures to be applied by training organizations when providing competency-based training for aeronautical personnel; in particular, procedures for the development and implementation of the MPL to support Annex 1 requirements.

This document does not carry the status attributed to Standards adopted by the ICAO Council in Annexes to the Convention and, therefore, does not fall under the obligation imposed by Article 38 of the Chicago Convention to notify differences in the event of non-implementation. Regardless, in the interest of global uniformity in the implementation and acceptance of MPL training programs, States are encouraged not to deviate unnecessarily from the procedures and processes detailed in PANS-TRG and are required to publish their significant differences in their Aeronautical Information Publication (AIP). As an example, PANS-TRG outlines a methodology for effectively applying Instructional System Design (ISD) processes when implementing competency-based training programs. It recognizes that there are several different ISD methodologies that can be employed with the same results. However, it also cautions the reader that *"so long as the methodologies contain the ISD elements that govern the three basic procedural steps of a needs analysis, design and production, and evaluation*", a differing ISD model would be considered acceptable.

Particularly, the "MPL Training Scheme" reflects the first-ever model to guide organizations in constructing an MPL course. Current courses have evolved from there and tend toward the use of MPL Phase 2 devices, type-specific FSTDs from Basic Phase onwards.

MPL Phases 1 / 2 / 3 / 4 are also referred to as **Core Flying Skills- / Basic- / Intermediate- / Advanced-Phase**. It should be understood that even the breakdown into four phases is a preliminary conceptual model for MPL to facilitate the transition from the hours-based to competency-based training. A mature competency-based training scheme does not need any division into phases. It only requires a clear definition of the terminal training objectives and a valid and reliable databased Student Assessment and Grading System. This system must assure that the novice-to-expert transfer follows the predetermined NORM in all relevant competencies, based on a seamless continuous assessment of every single training lesson. The basic ICAO framework outline of phases, content and devices is illustrated in PANS-TRG, Chapter 3 Appendix 1[1] *MPL Training Scheme* (refer to Attachment 7 in this document) and should be seen as a guideline only.

In this context, Phase 3 training should be conducted on a type-specific device (congruent to the graduate's first line aircraft type) during which type rating training tasks are already conducted and continued into Phase 4, with deliberate focus on the accurate application of approved operator-specific procedures for that aircraft type.

Note: The definition of the different devices is contained in ICAO Doc 9625 Edition 3, Manual of Criteria for the Qualification of Flight Simulation Training Devices Volume I – Aeroplanes, which was published in 2009.

7.4 The Numerical MPL Envelope: Training Hours and Landings

7.4.1 Minimum Parameters – MPL

ICAO Annex 1 MPL provisions intentionally provides room for innovation and creativity. In the competency-based MPL course in ICAO Annex 1 there are only three fundamental parameters which must be met:

1. Training in an actual training airplane must not be less than for a PPL (and must additionally include night flying, introduction to basic instrument flying, upset prevention and recovery).

   Note: MPL does not require the actual issue of a PPL, although it may be beneficial for motivation and self-esteem and under certain national regulations in context with the conduct of the Base Training.

2. Total training time, the sum of aircraft and FSTD, must be at least 240 hours (flown as PF or PM).
3. At least 12 take-offs and landings are performed in Base Training (with the possibility to reduce to six under the conditions described in PANS-TRG, 3.3.5[2] and with the appropriate Licensing Authority's approval) on the airplane for which the type rating is sought (without passengers on board and not

[1] To become Part II, Section 1, Appendix 2 to Chapter 1 in edition 2 of PANS-TRG (applicable on 10 November 2016).

[2] To become Part II, Section 1, 1.3.5 in edition 2 of PANS-TRG (applicable on 10 November 2016).

providing a commercial air transport service), before the MPL graduate is allowed to start the IOE phase.

The terminal measurement criteria for competency-based courses is the sustained outcome (consistently achieving targeted levels of competencies). Training time needed to reach this goal is of secondary importance.

7.5 Operator Specific Training

Some operators might wish to include specific training such as Low Visibility Training, Performance-based Navigation (PBN) procedures, etc., in the Advanced Phase of the MPL course and before starting IOE. Coordination with the Civil Aviation Authority is necessary to allow for such provisions.

7.6 ATO Experience

Previous experience in ab-initio training is a legal requirement of most CAAs for the partnering ATO responsible for the overall conduct of an MPL training course (ICAO Doc 9868 App 3 to Ch 3, 3.1 a): “Only ATOs that are familiar with ab-initio training or airline training should be considered, at least initially”).

7.7 Initial Planning for MPL Courses

The initial design of an MPL course should follow these steps:

- Involve the appropriate Licensing Authority as well as the Certificating Authority of the State of the operator from the outset, as subsequent steps may require their inputs and approval
- Set up the cooperation framework between operator and ATO
- Establish administrative processes and time lines between operator and ATO
- Establish an effective quality assurance system designed to ensure compliance with all regulatory requirements and stated objectives
- Establish an electronic student assessment and grading system consistent with the performance measurement criteria used by the partnering airline

7.8 Continuous Improvement

Competency-based MPL training prescribes continuous course improvement based on continuous student assessment and on feedback from the operator at least until the completion of the IOE, including the first line check. Ideally, performance measurement should extend until the MPL pilot has upgraded to Captain.

MPL allows for a flexible allocation of training hardware and courseware within certain limits. Therefore, course quality management must depend not only on content and delivery, but also on performance measurement and course evaluation.

7.9 No Simple Re-Arrangement of Courses (CPL to MPL)

In order to design an MPL course it is not sufficient to rearrange existing modules of traditional courses into an MPL-like course structure. Examples of this approach exist today and the results have been mediocre at best. Such a design may appear to work at the start, but is contradictory to the MPL philosophy, as intended under ICAO Doc 9868. To follow the traditional process of employing modular / inventory-based / box ticking training methodologies is incompatible with the underlying philosophy of competency-based training and assessment, which is based upon achieving scientifically arrived at standards of excellence directly related to job/task specific objectives. The resources needed to design an effective MPL course are considerable and should be planned.

7.10 Differences in MPL Courses to Date (2014)

From the information above, we have a clearer understanding why existing MPL courses differ from each other. Not only do solutions for the Core Flying Phase (1) vary, but Basic and Intermediate Phases (2 and 3) show significant differences between providers. Some ATOs use propeller driven single-engine (SE) and/or twin-engine (TE) piston airplanes in Phase 2, others use light jets, and some use 50-ton jet transport Multi-Pilot Aeroplanes FSTD of the type the students will eventually operate, at an early stage of the course.

7.11 ICAO Course Design Model

In PANS-TRG, ICAO uses the ICAO course development methodology to construct training courses. Other methodologies may be used as well, "*so long as the methodologies contain the ISD elements that govern the three basic procedural steps of a needs analysis, design and production, and evaluation*". Competency-based training assumes an agreed set of pilot competencies will be developed during the training course. In an ideal situation the operator/ATO team working on the development of an MPL course would use the existing set of core competencies in the operator's performance assessment system, if available and applicable. If not, a set of core competencies will need to be developed, using inputs from the operator and the ATO to support the MPL program. The same set of core competencies would support selection criteria during pilot aptitude testing. They are the core competencies to be trained on and achieved during the MPL course including type rating training, and would be used by the operator during IOE and subsequent training, including upgrading to Captain.

7.12 Review Boards

In the absence of reliable scientific data at this time, the chosen path under MPL is to allow for gradual innovation based on accumulating empirical feedback. For the first years of MPL operations, MPL Review Boards, chaired by the appropriate CAA, should be established to compare the various outcomes, improve upon existing implementation efforts and competency-based regulatory frameworks, and facilitate the timely distribution of best practices and lessons learned.

Section 8—Training Locations

8.1 Regulatory Provisions

ICAO has established governance criterion that must be in place before organizations can begin to consider establishing competency-based training or hiring graduates of such programs. In so far as MPL training is concerned, the sheer scope of an ab-initio training syllabus indicates that there is very little likelihood that one single organization will be capable of providing the required training. It is even more unlikely that one organization will be capable to conduct such a highly specialized program in its entirety at a single location. For this reason, several CAAs have had to establish new or refined certification regulatory structures that recognize the need for multiple partnerships between entities to produce thoroughly trained ab-initio pilots ready to take on the responsibilities of a First Officer in a modern airline. This is discussed in more detail in Section 16 of this manual.

Because of the dynamics and objectives of such a complex syllabus, initial theoretical training, flight training on aeroplanes and flight simulator training often take place at different locations. Many MPL courses also use several different ATOs and/or bases of operation to deliver the training. However, it has to be understood that the demands placed upon the operator, ATO and the Authority are substantially higher when the number of program participants or training venues increase. From a regulatory perspective, regardless of the number of stakeholders involved, whenever an application to conduct pilot training is submitted for approval there can only be one managing authority having overall responsibility for the content and fidelity of the training program. This issue is also covered in greater detail in Section 16 of this manual.

8.2 The Ideal Solution

In line with the concept of MPL training as a fully integrated program, the ideal solution arguably would be to locate all theoretical and practical training at one single location. However, this preferred arrangement has proven to be unnecessary whenever ATOs have employed thoroughly developed quality assurance practices, particularly those that have instituted exchange/visit programs to provide their staff with exposure to different levels of pilot training and flight operation experiences.

Any arrangement designed to enhance the seamlessness of the delivery of an MPL program should be pursued with vigor.

8.3 Advantage of a Single Location

For course designers with the option to implement MPL training at a single integrated location, there are at least two prominent advantages:

1. The integration of the instructor personnel between the most airline-experienced type rating instructor (TRI) / synthetic flight instructor (SFI) / flight simulator instructor (FSI) to least airline-experienced flight instructor (FI)) would bring potential benefits like students' learning efficiency and motivation.

2. The interaction between new students, who have just started the course, with those who have experienced the different phases of the program can provide valuable advice and support.

Integration at the same workplace enables frequent instructor interaction, with cross-pollination of ideas and instructional focus, as well as workplace efficiencies such as flexible theory instruction. Instructors for the core flying skills and basic phases benefit from frequent exchange with instructors working in the intermediate and advanced phases. Such cooperation facilitates procedural harmonization and helps eliminate general-aviation style training practices from unintentionally influencing core and basic flying skills development. In this situation, co-located instruction becomes convergent, focused on the primary objective: training for airlines. Another benefit is the creation of a single-team mentality, rather than the traditional silo-type cells of expertise often seen in the training industry.

8.4 Remote or Multi-Locations

Remote locations, especially across national boundaries, make program integration and information sharing more difficult to achieve. However, there are much more complex hurdles to overcome whenever various phases of MPL training take place in differing regions or national territories. These hurdles frequently put into jeopardy the functionality of the quality assurance systems and the effectiveness of the Licensing Authority's oversight of the training. Section 16 of this manual provides more detail.

8.5 Non-Native English Speaking Students

For MPL training providers to non-native English speaking students there is a clear advantage to train in an English speaking environment to "force English speech", embed a more international culture; and rapidly improve English language proficiency. This is generally achieved at an ATO abroad, in an English speaking country, but the option also exists to set up an ATO in the students' country of origin, with English as the mandated medium of instruction and study, as well as in the student hostel within the facility.

8.6 Remote Training Aerodromes

The use of remote General Aviation (GA) aerodromes for the majority of the flight training may not be the optimum solution for MPL training. While these airfields may provide an undisturbed training environment for VFR flights and circuit training, aerodromes with commercial air operations and a higher operational complexity provide better exposure and interaction with ATC and commercial traffic.

8.7 Environmental Factors

Economical and weather aspects must be considered. A pure blue-sky, clear weather environment, may actually work against the objective of MPL training which also includes flight in IFR conditions. The reduced requirement for training in light aircraft (compared to CPL) exposes the ATO to less training disruption risk from weather or other operational constraints.

Section 9—Theoretical Knowledge Instruction (MPL Theory)

9.1 Task to Complete

During the development of MPL the ICAO Flight Crew Licensing and Training Panel did not review theoretical knowledge requirements but did identify the need to do so. IATA and IFALPA support this activity. Most theoretical training of the MPL program remains identical to the inventory-based aeronautical knowledge required for the classic ATPL, validated via the conventional ATPL theory examination. This approach has been driven by the fact that the majority of Licensing Authorities have chosen to adopt the Annex 1 knowledge requirements, unchanged: the MPL course shall comprise theoretical knowledge instruction to the ATPL (A) knowledge level.

At least one CAA already administers an entirely new set of “Mastery Tests”, which are designed to validate that an MPL applicant possesses the knowledge levels required to safely and effectively assume the duties of a First Officer in a modern day airline. This set of examinations assesses not only the applicants’ overall comprehension of the various aviation-related areas of study, but also their ability to correctly apply that knowledge using real-life scenario-based questions chronologically delivered in a final “phase of flight” exam.

At the ICAO MPL Symposium in December 2013 in Montreal, it was agreed that new global guidance on the content of the theoretical training and subsequent mastery exams for the MPL remains an outstanding task for ICAO to oversee, subject to the availability of resources.

The task would be to develop and implement a competency-based theoretical knowledge instruction system that supports the MPL program outcome. Mastery exams or tests should be scenario-based.

9.2 Integration of Theory and Practical Training

ATOs may deliver the theoretical training in two modules separated by the core flying skills phase, as implemented in some MPL training programs, or use the PANS-TRG better guidance: “Each phase of the MPL Training Scheme shall be composed of instruction in underpinning knowledge and in practical training segments. Training in the underpinning knowledge requirements for the MPL shall therefore be fully integrated with the training of the skill requirements”.

Modern adult learning processes advocate integrating the theoretical and practical aspects of training for best results and retention. Just as the intent of PANS-TRG allows modifications to traditional training but encourages a rapid transition to a more ISD designed program, PANS-TRG also recommends the integration of theoretical and practical training elements for the ultimate solution. Program designers,

working in conjunction with other stakeholders of the MPL program, should strive to integrate the training to the greatest extent possible.

9.3 Theoretical Knowledge Examination

In most cases the official Theoretical Knowledge examination is administered before commencing the practical training in the Basic Phase (2). Notwithstanding the wording used in Annex1, the following amplifying note appears in ICAO Doc 9379, Part II of Manual of Procedures for Establishment and Management of a State's Personnel Licensing System:

Note: Annex 1 requires that multi-crew pilot license applicants meet the knowledge requirements for an airline transport pilot license. This standard should not be literally interpreted to mean that an applicant must successfully complete those same examinations originally designed by the State to be administered to airline transport pilot license applicants. Since holders of a multi-crew pilot license are expected to immediately enter into commercial air operator's line-indoctrination programs without "bridge" or supplemental training, licensing authorities may wish to review their existing examination structures. This analysis may suggest that it would be more beneficial to develop a separate set of qualifying knowledge examinations for the multi-crew pilot license. This could well provide authorities with a more effective validation process, which more accurately identifies the existence of the knowledge needed for operating a modern transport category aeroplane in an international commercial air transport operation.

This highlights the need to ensure that MPL candidates are appropriately tested on their knowledge.

9.4 Underpinning Knowledge (Applied Theoretical Knowledge)

PANS-TRG Chapter 3.3.2[3] and EASA Part-FCL Appendix 5 § 9 state: Each phase of the MPL training scheme shall be composed of instruction in underpinning knowledge and in practical training segments.

Underpinning knowledge is primarily facilitated by the instructor as an integral part of the training lesson and must not be confused with the initial theoretical training which is delivered without much direct reference to the practical parts of the course. For example, in the core flying skills phase the focus of underpinning knowledge is drawn from the foundational theoretical training topics and for the basic, intermediate and advanced phases it focuses on knowledge elements from instrument flight and from the multi-pilot type rating course and (former) multi-crew cooperation course.

Each phase of practical training includes coaching in the application of underpinning knowledge. Training in underpinning knowledge is therefore ongoing and fully integrated throughout the course.

[3] To become Part II, Section 1, 1.3.2 in edition 2 of PANS-TRG (applicable on 10 November 2016).

For example, as part of the lesson preparation, students work through the lesson description which contains a section referring to the underpinning aeronautical knowledge necessary to successfully conduct the particular training tasks in the lesson to come. Thus, theory topics are matched with practical lesson content. Such “just in time” event-based knowledge acquisition is far more attractive to students than the traditional inventory-based teaching of the required subjects of aeronautical knowledge lined-up along a theory curriculum without any direct affiliation to practical application. Where the environmental and logistical factors allow it, the initial theoretical training, the extension of the underpinning knowledge via the instructor and the practical training may be integrated in a systematic manner as per the ISD design of the program.

Section 10—Instructor Qualification

10.1 The MPL Instructor's Role

The most advanced training equipment and program will not address training objectives effectively without appropriate instruction. MPL sets the instructor standards bar to a higher level.

10.1.1 A New Standard of Instructor for MPL

MPL mandates more relevant instructor requirements and sets out to augment the new training equipment (aircraft and FSTD) standards with a new standard of instructor. All instructors should have successfully completed an approved MPL Instructor Training course. Familiarization with the competency-based training and assessment system and the use of TEM countermeasures in daily routine operations are the key enhancements to the instructional skillset of a new MPL instructor. A precondition for instructor selection should be motivation and the ability to teach with enthusiasm and empathy.

10.1.2 The Optimal MPL Instructor

MPL instructor personnel should be motivated and capable of delivering better training than usually demanded. ATOs should ensure that the instructors of the core flying skills phase are experienced and integrated in the operator/ATOs instructors' team.

All Instructors must be trained to understand both airline and ab-initio training objectives. Elements to be considered when assigning instructors to conduct MPL training are:

- Careful selection to ensure high levels of motivation, empathy, disposition for an instructor's role.
- Effective MPL instructor initial and recurrent training, including competency-based instructional skills.
- Attractive career paths and remuneration to enhance retention and continuity.
- MPL flight instructors must be experienced and, for Phase 2, qualified in multi-crew operations. Using flight instruction as a cheap way to build experience is not feasible. ATOs should strive for low turnover rates to ensure continuity.

Some airlines involve Line Pilots, who have received special qualification training in the MPL program as instructors.

10.1.3 Regulatory Requirements for MPL Instructors

The *Procedures for Air Navigation Services — Training (*PANS-TRG*)* are complementary to the Standards and Recommended Practices (SARPs) of ICAO Annex 1. Annex 1 contains Standards for the issuance of the flight instructor rating or authorizations and for granting authorizations to flight simulation training device (FSTD) instructors. PANS-TRG contains the qualifications to be held, and the competencies to be demonstrated, by those instructors employed in a competency-based training program. In competency-based programs, instructor competencies are made explicit, and instructors have to demonstrate their instructional skills and their knowledge of the subject matter and training course content. Instructor competencies relative to flight simulation and the delivery of FSTD-based training are also essential where extensive use of FSTDs is made.

In consideration of the above, CAAs have produced various schemes of qualification requirements for MPL instructors. These qualification requirements depend on the phase in which the instructor intends to teach and recognize the exceptional importance of instruction in an MPL training environment. The CAA should exercise careful oversight of instructor qualifications when granting the appropriate authorization to MPL instructors conducting instruction for the various phases and parts of an MPL approved program.

10.1.4 Example of an MPL Instructor Requirement Set

PANS-TRG contains provisions for the qualification and competency framework of instructors, including MPL instructors.

Guidance Material of EASA Part-FCL shows one possible arrangement.

GM (Guidance Material) to FCL.925

MPL Instructors

The following table summarizes the instructor qualifications for each phase of MPL integrated training course:

Phase of training	**Qualification**
Line Flying Under Supervision in accordance with Part OPS	Line Training Captain or TRI(A)
Phase 4 – Advanced Base Training	TRI(A)
Phase 4 – Advanced Skill Test	TRE(A)
Phase 4 – Advanced	SFI(A) or TRI(A)
Phase 3 – Intermediate	SFI(A) or TRI(A)

Phase of training	Qualification
Phase 2 – Basic	• FI(A)/Instrument Rating (IR) Instructor(A) + IR(A)/Multi-Engine/Multi-crew cooperation (MCC) + 1500hrs multi-crew environment + IR(A) instructional privileges, or • TRI/SFI + IRI(A) • FI(A) + MCCI(A), or SFI(A) + FI(A) or • TRI(A) + FI(A)
Phase 1 – Core Flying Skills	• FI(A) + 500hrs, including 200hrs instruction • Instructor qualifications and privileges should be in accordance with the training items within the phase. Synthetic Training Instructor for appropriate exercises conducted in a Flight Navigation and Procedures Trainer or Basic Instrument Training Device.

TRI (A) = Type rating instructor (aeroplane); TRE(A) = Type rating examiner (aeroplane); SFI = Synthetic flight instructor; IRI = Instrument Rating Instructor.

10.1.5 MPL Flight Instructor (FI) Airline Jump Seat Rides

Exposure to the partnering airline jump seat rides or refresher lessons in the simulator (especially LOFT lessons) are particularly beneficial during MPL FI training to instill a better understanding of the airline's culture and operations.

10.1.6 MPL Instructor Training Under EASA

The recommendations in ICAO PANS-TRG Chapter 6 and the Attachment to Chapter 6[4] describe procedures for the qualification and the competency framework for instructors, including MPL instructors.

Attachment 4 contains EASA PART-FCL Subpart J, 925, and AMC1 and AMC2 FCL 925 as an example of how to prepare instructors for their role. The main focus of this MPL Instructor Training course is on familiarization of instructors with MPL regulations, competency-based training and assessment and threat and error management.

[4] To become Part I, Chapter 3 and the Attachment to Chapter 3 respectively in the 2nd edition of PANS-TRG (applicable 10 November 2016).

Section 11—Upset Prevention & Recovery Training (UPRT)

Upset prevention and recovery training is a requirement of the Multi-Crew Pilot License.

Guidance is provided by ICAO Doc 10011, *Manual on Aeroplane Upset Prevention and Recovery Training* (MAUPRT), which covers:

- Awareness and avoidance, summarized as **PREVENTION** and,
- **RECOVERY** from upsets.

11.1 Prevention

Prevention is paramount. Preventing divergence of an aircraft from its intended flight path is a continuous process accomplished by the crew through the continuous application of the airline's set of core competencies. As it is essential for crews not to wait until an upset situation has developed, the focus of UPRT is on PREVENTION; and fixation on the RECOVERY part should be avoided.

11.2 Recovery

Once an Upset has occurred RECOVERY to a stabilized flight path is achieved by applying the recovery techniques from Nose-High and Nose-Low attitudes, developed by aircraft manufacturers and described as OEM Recommendations in ICAO Doc 10011 and/or by applying the type-specific STALL RECOVERY procedure.

11.3 Integration of Threat and Error Management (TEM)

In MPL training programs the prevention and recovery of upsets should be directly connected to TEM and be delivered in a fully integrated manner. Conceptually, TEM is integrated within UPRT as shown in the table below.

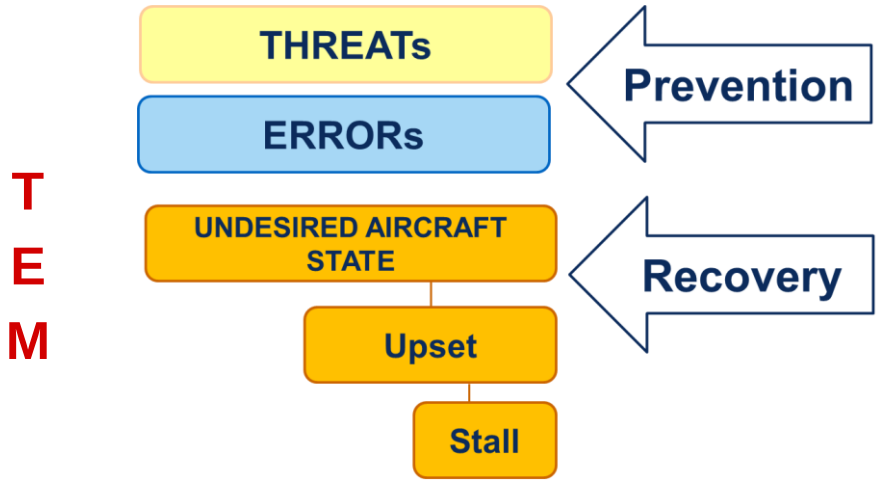


Figure 3. TEM Integrated within UPRT

Threats and errors must be recognized and managed in order to prevent Undesired Aircraft States (UAS).

Aircraft Upset are defined conditions of UAS and STALL is a subset of an aircraft upset.

11.4 In which MPL Phase do we deliver UPRT?

UPRT in an MPL course must be delivered at three levels:

a) On-aeroplane UPRT in an airplane

b) Multi-crew non type-specific UPRT in an FSTD (basic and/or intermediate phase)

c) Type-specific UPRT in an FSTD of the specific type (latest in the advanced phase)

The general PANS-TRG MPL scheme suggests delivering UPRT in Phase 2. However, some States allocate on-aeroplane UPRT to Phase 1. There are good reasons to deliver UPRT exercises additionally at later stages of the course.

When delivering UPRT, theoretical knowledge, especially in energy-management, aerodynamics and aircraft performance (including at high altitude) and the effects of surprise and startle on human performance, need to be consolidated.

11.5 Benefits of On-Aeroplane UPRT

Compared to and in addition to teaching flying skills in FSTDs, on-aeroplane UPRT should first and foremost be a confidence-builder. It serves mainly human-factor training objectives and less flying skills training. Therefore, the risk of negative transfer of training from small aeroplanes to large aeroplanes is mitigated.

On-aeroplane exposure to variations from 1g and training of counterintuitive behaviors is required for the pilot to build resilience and the psycho-physiological skills required to apply appropriate control inputs in the event of an upset. For optimum delivery of UPRT objectives, the use of an aeroplane capable of all attitude maneuver training would be recommended.

On aeroplane UPRT can be a valuable tool to build long-lasting confidence for the young pilot. This confidence is psychologically built on realistic proof of the student's ability to control and recover the airplane to normal flight from any "3D" upset situation. The existence of such proof forms the underlying basis of true confidence and is a prerequisite for the ability to contain the effects and the duration of startle.

Not simply flying skills, but the timely employment of effective strategies to prevent such an occurrence or, if unforeseen, during the actual recovery stage of an upset, should be the success-critical elements in the on-aeroplane UPRT module of an MPL course. The recovery strategies should include how to manage surprise and startle induced by unusual attitudes and stall, and how to perform even counterintuitive actions under the presence of deviations from 1g flight.

11.6 UPRT is Not Aerobatic Training

On-aeroplane UPRT should not be misinterpreted and approached in the same manner as aerobatics training. Although basic aerobatics do contribute to certain pilot competencies, such as Airplane Flight Path Management, manual control, and Situation Awareness, aerobatics are neither required during commercial pilot licensing nor do they contain the same training objectives as UPRT. Simply put, basic aerobatics focus on performing a sequence of precision maneuvers, passing through defined attitudes and using effective energy management.

UPRT focuses exactly on the contrary: the prevention of aircraft states outside of normal operating parameters and the most effective recovery from these abnormal attitudes/speeds, which often result from poor energy management. From that perspective, UPRT modules should be designed to develop the full spectrum of analytical reasoning skills required to rapidly and accurately determine the best course of recovery action during periods of high stress.

11.7 UPRT Instruction

UPRT-qualified instructors are essential for this task. Specific instructor training is required prior to delivering UPRT. Whether training is in an FSTD or an airplane, UPRT involves the delivery of complex concepts and

relationships, often in a dynamic setting. It is essential therefore that risks be minimized through strict and disciplined operational safety management and the required instructor qualification.

On-aircraft and FSTD UPRT should be "from the same page". Both modules should be interconnected so that they complement each other. Simply put, FSTD training is the "*look*" module, and on-aeroplane training is the "*feel*" module. Therefore, on-aeroplane instructors should also observe FSTD UPRT, especially the type-specific UPRT module, in order to ensure that negative transfer of training from small aeroplanes to heavy jets is avoided.

FSTD instructors should have experienced on-aeroplane UPRT at least once in their career before teaching UPRT in the simulator, because simulators can only produce about 10% of the motion cues associated with upsets. Instructors must close this gap by verbally pointing out the associated psycho-physiological impact of maneuvers practiced in FSTD training. They must ensure that human factor aspects are included in FSTD training lessons.

FSTD-specific instructor training focuses on the capabilities and limitations of the FSTD, its validated training envelope, the instructor operating station, upset- and stall-specific aircraft manufacturer recommendations, and the avoidance of negative training.

Special attention should be given to instructors teaching on-aeroplane UPRT. Required instructor performance in the all-attitude/all-envelope environment is beyond that experienced in normal operations. By no means should an ATO assign this task to flight instructors without specific qualification. On-aeroplane UPRT instructor training focuses on risk/safety-margin management, strong instructional skills with respect to human factors, students' psychophysiological reactions (startle and surprise), confidence building, and in-flight recovery skills when the instructor needs to intervene to maintain flight safety.

On-aeroplane UPRT should be conducted under strict operational control procedures involving appropriate training airspace areas, minimum dispatch and weather conditions and within a well-structured safety management system (SMS) environment.

ATOs should consider outsourcing the on-aeroplane UPRT to a specialized organization where the availability of suitable aeroplanes and instructors is assured. In case of outsourcing, the MPL ATO remains responsible for the delivery of UPRT as part of the overall MPL program (see Section 3 for examples of other contractual arrangements).

11.8 Training Aeroplanes

ICAO did not mandate the use of aerobatic aircraft for on-aeroplane UPRT, but expressed that ICAO does not intend to "dissuade" States and ATOs from using them.

ICAO Doc 10011 states:

> "3.3.1.3 It is important to make the distinction that UPRT is not synonymous with aerobatic flight training. ..... From the human factors aspect, aerobatics does not specifically address the element of "startle".

> Nor does aerobatic flight training necessarily provide the best medium to develop the full spectrum of analytical reasoning skills required to rapidly and accurately determine the course of recovery action during periods of high stress. UPRT should address these psychological and reasoning responses, which are significant factors in most LOC-I accidents. These skills can be acquired using non-aerobatic aeroplanes, but the range of possible manoeuvres is appreciably smaller than for more capable aeroplanes. Given the resources available within the State, the additional safety benefits and the additional costs, the CAA should consider whether the use of those more capable aeroplanes, providing for an optimum on-aeroplane UPRT experience, are to be required for the issue of either a CPL(A) or MPL."

and its Appendix, Competency-Based UPRT Programs, On-aeroplane training, states:

> "... Use of aerobatic aeroplanes would be the optimum solution to provide maximum training value and safety margins".

Therefore, though Annex 1, PANS-TRG and Doc 10011 do not require all-attitude UPRT and the use of aerobatic aeroplanes, conducting UPRT using such maneuvers and aeroplanes for the MPL provides the most effective training solution.

Normal or Utility category aeroplanes (certified to <60 or <90 deg bank) are not suitable to achieve the complete human-factor training outcome and can only provide part of the desired outcome. Technically and operationally the use of Normal or Utility category aircraft for on-aeroplane UPRT may create substantial safety risks, depending on the training maneuvers.

11.9 Fidelity Requirements for FSTDs

UPRT conducted in FSTDs requires a set of features (the level of cueing, simulator modeling, visual, motion and environmental features) that are necessary to support UPRT in synthetic devices. Most tasks can be trained in existing modern FSTDs but certain tasks may exceed the capabilities of an FSTD because the aerodynamic modeling or motion cueing may not be able to accurately replicate the event. In order to avoid negative training, course designers must thoroughly evaluate the fidelity of the available device before using it for UPRT. Guidance is available in ICAO Doc 9625 and in the ICATEE *Research & Technology Report*.

For example, the flight models of today´s FSTDs do not adequately replicate the approach-to-stall cues. They are not validated beyond the critical angle of attack and the aerodynamic stall characteristics do not reflect reality. To expose crews to un-validated flight regimes should therefore be avoided. Stall-recovery training should presently be limited to approach-to-stall training, hopefully with enhanced modeling of aeroplane-specific cues including stick pusher activation (if installed), and recovery should be initiated at the first indication of stall. FSTD enhancements to allow recovery training from aerodynamic stall can be expected from FSTD manufacturers in the future.

Section 12—Aeroplane in MPL Training

12.1 Current Status

Practical flight training is divided into airplane and simulator training. ICAO Annex 1 prescribes that no less than the requirements for PPL training must be fulfilled in the core flying phase of an MPL, which is 35 hrs including 10 hrs solo, plus basic instrument, upset prevention and recovery training and night flying. At the time of publication, the average global amount of training hours in small, propeller-driven airplanes in the core flying phase is approximately 80 hrs including 10-15 hrs solo flight.

12.2 Aeroplane Training

It is a fundamental aspect of MPL course design to thoroughly identify the tasks, objectives and outcomes applicable to aeroplane training as identified in the ISD process. The provision above has been vigorously discussed amongst training experts for years. To date, no one has been able to validate or justify the specific amount of light airplane training required for airline pilots. However, there is general consensus that there are essential learning objectives that can only be trained in an aeroplane.

12.3 Use of Light Multi-Engine Aeroplanes

Training in light multi-engine aeroplanes is optional in MPL courses. While there is no question that a student can learn basic one-engine-inoperative handling principles on a small propeller-driven twin-engine airplane, compromises always had to be made for safety reasons if such training was performed at an initial stage of an ab-initio course.

12.4 Reasons

12.4.1 Flying Characteristics

The flying characteristics of a swept-wing jet transport are different from a small propeller-driven twin. The compromises and differences have traditionally been addressed during the multi-crew cooperation (MCC) course and in the later type rating course.

12.5 Performance

Most light (CS23/FAR23) twin aeroplanes have very limited performance with one engine inoperative. For safety reasons, ATOs should not actually shutdown and restart engines in the airplane. Engine-out performance in non-turbopropeller powered airplanes is simulated by adding thrust on the “dead” engine to counteract the increased drag of the non-feathered propeller.

12.5.1 Flight Controls

Control inputs and rudder trim input are different in light twins compared to swept-wing jet transport category airplanes.

12.5.2 Scenarios

V1 does not exist in CS23/FAR 23 airplanes.

Engine failures at low speed (between V1 and V2), during rotation and at low altitude (from lift-off to 400ft) are too dangerous to be trained in the real airplane.

Vmca exercises close to Vs are dangerous in some light twins and can lead directly into a spin.

For the above reasons, on-aeroplane training, using light multi-engine propeller aeroplane, should be considered for suitability when designing an MPL course. The availability of FSTDs and the destination aeroplane type must be considered.

Section 13—Flight Simulation Training Devices (FSTD) in MPL Training

13.1 Use of FSTDs in Integrated Competency-Based Training Programs

With the creation of the MPL, ICAO paved the way for ATOs to make greater use of advanced synthetic training tools for ab-initio pilot training. Flight Simulation Training Devices (FSTD) are available in all levels of fidelity and the regulatory design of the MPL allows, for the first time, course developers to make use of this technology within the limitation given for this license.

The most effective process to identify the suitability of a particular FSTD is to first design a competency-based training curriculum and thereafter allocate the required feature fidelities to support the instructional intent. MPL courses should not be "built around" the existing equipment of an ATO. Rather than altering the course requirements, an upgrade of the existing FSTDs should be considered or suitable FSTDs acquired. The ultimate goal is to create operational realism within the simulation environment and allow simulation to effectively complement aeroplane training. This accelerates learning and enables the adult learning process.

Such instructional system design benefits both the training of technical and non-technical objectives, encompassed by TEM.

- Successful management of real threats and errors experienced in reality during aircraft training phases facilitates the maturing process of human factors needed to increase resilience and confidence.
- Evolving from there, FSTD training allows instructors to facilitate the full scope of operational challenges and type specific training needs to enable the MPL students to reach the desired level of competency.

Several FSTD design characteristics should be considered when allocating FSTDs to MPL training programs and training objectives in the different phases. They include:

- Type specificity
- The fidelity of the visual system
- The fidelity of Simulated ATC Environment (SATCE)
- The fidelity of the communications functionality
- The fidelity of simulation for UPRT[5], GPWS, TCAS, windshear, turbulence and other weather phenomena

[5] Refer to Section 4 of ICAO Doc 10011 for specific guidance on the use of FSTDs for aeroplane upset prevention and recovery training.

- The design of the instructor station (IOS) to support effective teaching and assessment of performance
- Provision for an observer seat at the IOS to allow student-observer-time and instructor training
- Consideration that the usage of higher fidelity training devices in Phase I and in Phase II in particular enhances training quality in Phases III and IV

Note: The list above does not imply any priority.

Instructors should be trained on how to make best use of the FSTD.

- "Train the Trainer" programs should ensure instructors are qualified to effectively use the capabilities of the device.
- Simulator Instructors of earlier MPL Phases using lower levels of FSTD fidelity should be provided with the opportunity to observe training lessons in Type VII (Level D) FSTDs of the Intermediate or Advanced Phase. This will allow them to become aligned with requirements and the level of fidelity featured in the final stage of training.

13.2 FSTD Fidelity

The international fidelity requirements for utilizing FSTDs in competency-based training programs are specified in ICAO's Annex 1, Doc 9868 (PANS-TRG), Doc 9625 and Doc 10011.

Doc 9625, Volume I, Part I, Appendix B, 2.10 provides guidance as follows:

> "2.10 Guidance during MPL license implementation and MPL training programmes introduction:
>
> "It is suggested that, whilst the MPL training programmes are being introduced and validated, the highest appropriate level devices are used to facilitate the safe and efficient implementation of the MPL requirements."

The European Aviation Safety Agency has also published European requirements in EASA PART FCL, Appendix 5.

13.3 FSTD Design Trends in Support of MPL and Training Industry

1. SATCE systems are still in development and under test as the industry moves toward a semi-automated SATCE solution that is robust for training
2. Improved motion and modeling of approach / landing phases, stalls, and all attitude training
3. Improved compliance with upset recovery requirements
4. Improved, more user-friendly instructor operating stations (IOS) with advanced instructor tools to assist the instructor in interpreting training events and facilitating better learning

5. Off-board IOS allows better peer-to-peer learning in the cockpit and has been successfully used in military and ATC settings) [*Doc 9625 already allows off-board IOS for some helicopter FSTDs*]
6. Monitoring of pilot performance from FSTD data (similar to QAR / FOQA) using similar tools to track training performance
7. Improved play-back systems for sessions debrief
8. Improved lateral cueing close to touch down and in roll-out and taxi
9. Improved simulation of aircraft bending and individual tires touch-downs on landing
10. Animation of actual incidents and accidents allowing crews to try out scenarios and compare performance

Note: The 4th edition of Doc 9625, Volume I contains new FSTD qualification criteria for at least points 1, 2, 3, 4, 6 and 7 above.

Section 14—Simulated ATC Environment (SATCE)

Incorrect and inadequate communication between flight crews and ATC is known to be a significant causal factor in incidents and accidents. It remains a serious safety threat.

14.1 SATCE Systems in MPL

Although not yet fully evaluated through training, the eventual availability and widespread implementation of a simulated ATC environment (SATCE) is expected.

It is recommended that SATCE be adopted for all types of FSTD and all MPL training phases. Students in early phases may especially benefit from the introduction of SATCE to help with their knowledge of ICAO standard phraseology as well as building competency and confidence using radio communications, including in busy airspace, and managing task interruption.

Where students use English as a second language, early exposure to SATCE will help provide familiarity with ATC communications and also assist with developing aviation English language proficiency.

It is widely accepted among the flight training community that a semi-automated SATCE system is hugely preferable to instructor manual role-play of ATC communications. Manual delivery can vary in quality and may not follow ATC procedures or standard ICAO phraseology. It also distracts the instructor from his or her primary task, and sometimes the students from their concentration. Manual simulation of background radio traffic (also called “background chatter”) is impractical, especially if it is to be correlated with other traffic seen on the visual system or cockpit situational displays.

14.2 Regulations and Industry Guidance on SATCE

The EASA Part-FCL replaces provisions in the JAR-FCL. ATC simulation has been mandated in EASA Part-FCL for use with MPL training programs. The flight and simulated flight media minimum level requirements specify that ATC simulation is required for MPL Phase 3 and Phase 4 FSTDs (see Annex to ED Decision 2011/016/R, 15 Dec 2011).

ICAO Doc 9868 PANS-TRG mentions the provision of the Air Traffic Control environment in Attachment A to Chapter 3[6] [Competency-Based Training and Licensing for the Multi-Crew Pilot License – Guidance on the Design and Development of a Multi-Crew Pilot License Training Program]. EXTRACTS:

[6] To become Part II, Section 1, Attachment A to Chapter 1 in the 2nd edition of PANS-TRG (applicable on 10 November 2016).

§ 2.2 reads: "...starting with the Basic phase of training, use of FSTDs, ranging from part-task training devices, through generic systems to full motion, full visual, high-fidelity, type specific flight simulators that also **permit the introduction of interactive air traffic control environments,** will begin to dominate the training..."

§ 3.10.2 reads: "The Type III[7] FSTD (meaning the device used in phase 3) **must permit the progressive introduction of a sophisticated flight environment including ATC**, flight guidance systems, EFIS, FMS and TCAS."

ICAO Doc 9625, Volume I, 3rd Edition (*Manual of Criteria for the Qualification of Flight Simulation Training Devices*) was published in 2009 and the 4th edition was published in 2015.

Appendix A of Part II of Doc 9625, Volume I, Ed. 3 contains an initial set of proposed requirements for the feature "Environment – ATC". ICAO has updated this document in the 4th edition. The amendments include a more mature set of SATCE requirements that reflect the industry's progress on this subject.

Extracts:

Doc 9625-Volume 1, Part II Attachment O [Guidance for Environment – ATC] of the 4th edition, states:

"It is recognized that the flight simulation and training industry is currently developing training requirements and applications to enhance the simulation of the ATC environment. The use of simulated ATC environment in training is still in the adoption, testing and refinement stages of its life cycle.

Appendices A, B and C in Part II and in Part III of this manual contain guidance material. The features and requirements contained in those appendices concerning simulated ATC environment are not mandatory for either training approval or FSTD qualification at this time.

The content of these three appendices should be used as guidance to industry for the continued development and refinement of simulated ATC environment in FSTDs and other flight training tools. Further guidance material will be published in subsequent updates or amendments to this manual when sufficient experience has been gathered and requirements further reviewed and matured by industry.

Primary efforts by industry should be aimed at delivering simulated ATC environment throughout the MPL and other ab initio flight training programmes, including initial Type Rating. Once simulated ATC environment has been introduced and validated, the benefits are expected to be highly advantageous to all subsequent advanced training.

Experience has already demonstrated that early exposure to the ATC environment, even prior to first FSTD training, would be of significant benefit to student pilots. Training organizations should give consideration to extending simulated ATC environment training using Flight Procedures Training Devices (FPTDs) and other mobile or classroom-based tools. Attachment M contains guidance for the evaluation of FPTDs."

Further information that may be of help to FSTD operators and vendors on simulated ATC environment is available in **ARINC Report 439:** *Guidance for Simulated Air Traffic Control Environments in Flight Training Devices*, March 2014.

[7] The Type III of Annex 1 and PANS-TRG is referred to as Type VI in the more recent Doc 9625, Volume I.

This ARINC document builds upon that originally undertaken by the IATA Flight Simulator Working Group in 2002, and further developed in ICAO Doc 9625 Ed. 3 in 2009.

Chapter 3 provides a summary of SATCE features mapped to each MPL phase, and Chapter 5 contains guidance on the implementation of SATCE for MPL. ARINC 439 also contains guidance material on SATCE installation, maintenance and technology, along with considerations regarding device qualification and training approval.

ARINC 439 is providing the basis for ICAO's guidance and recommendations on the subject of SATCE for FSTDs, in the 4th edition of Doc 9625, Vol I.

What is clear to an experienced SFI/FSI is that any automated or semi-automated ATC environment system is hugely preferable to "instructor mimicking" of ATC; it is very difficult to do convincingly and impossible to synchronize with air traffic seen on the visual system.

14.3 Interim Regulatory Approaches to SATCE Requirement

While SATCE systems are being developed and evaluated, the Civil Aviation Authorities of the States conducting MPL courses are managing the requirement by allowing for alternative means of compliance (AMC). This allowance is seen as a practicable short-term resolution, and is expected to be withdrawn when SATCE systems have become available and demonstrate added value to training.

Current AMCs range from:

a) Flight instructors manually providing structured ATC services to the ownship (the legacy approach)

b) MPL students flying as additional crew members for a certain amount of sectors in the partnering airline's route network

c) Exchanging classroom training with air traffic controller students or visiting tower (and/or approach/area) controllers at their respective operational sites to gain a better understanding of pilot/ATC interactions and workloads

However, such initiatives are likely to be "ad hoc" and difficult to sustain throughout the training process.

14.4 Update – SATCE Systems in FSTDs

From research conducted at the World Aviation Training Symposium (WATS) in April 2011.

14.4.1 Technology

There are a number of potential delivery methods or technologies that may be used to achieve the provision of SATCE in FSTDs, and different approaches are likely to require different technologies.

The technologies needed to construct a semi-automated SATCE solution exist, but investment within the industry is not yet at a level necessary to complete development (by suppliers) and trial (by training providers) in a short time scale, despite the desire for improved communication training expressed by a number of airlines.

The area of most technical challenge is perhaps the provision of semi-automated ATC services to the ownship (student pilot to ATC and ATC to student pilot). This is likely to require technologies such as speech recognition (SR) and artificial intelligence (AI).

A technology mitigation available today is for the instructor to manage the ATC services to the ownship from the IOS, in a “manual role-play mode”. However, the drawback of this approach is that the flight crew can immediately tell when a call is for their flight (because the voice of the controller is different from that of the background radio traffic).

- **Availability:**

  SATCE systems are available in some of the latest generation FSTDs (higher level devices, Level D / Type VII), but functionality is currently limited to background radio traffic correlated with other traffic seen on the visual system by the flight crew.

- **Challenge to industry:**

  There has been recent progress on the initial challenge of clarifying the scope of SATCE and defining the functionality needed for training.

  There remains an investment challenge that is the proverbial “chicken and egg” conundrum. However, as the MPL is further established, it is hoped that customer demand will increase and confidence and investment in SATCE solutions will follow.

  The growing demand from airlines for improved training in this area, both in the MPL and in traditional pilot training courses, may also help boost market confidence and investment.

Section 15—MPL by Phases

General Note

It should be understood that even the breakdown into four phases is a preliminary conceptual model for MPL to facilitate the transition from the hours-based training to competency-based training. A mature competency-based training scheme does not need any division into phases. It only requires a clear definition of the terminal training objectives and a robust Learning Management System to assure that the novice-to-expert transfer follows the predetermined norm in all competencies, based on a seamless and continuous assessment of performance in every training lesson.

15.1 Considerations in Phase 1 (Core Flying Skills)

15.1.1 Instruction in Phase 1

Flight Instructors (FI) – see preceding considerations, and instruction for UPRT in Section 11.

SOPs: Pitch and power flying philosophy must be applied correctly so that there is no negative training in this phase and negative transfer of training to later phases is avoided. SOPs should be adapted to become consistent with Airbus (e.g. A320), Boeing (e.g. B737), Bombardier (e.g. CRJ), Embraer (e.g. Embraer 170), etc., SOPs. Stabilized final approaches should be flown instead of PPL typical approaches utilizing idle-power settings. Terms of General Aviation should be replaced by Airline / ATPL terminology (“take-off power” instead of “full throttle”). Callouts should be harmonized with the Annex 6 mandated structure and the SOPs of the partnering operator as far as possible.

TEM and theory-practice integration in Phase 1: TEM must be part of the student’s and instructor’s daily routine. Previously acquired theoretical knowledge must be applied, especially basic performance and meteorology. The relevant documentation must always be accessible in briefing rooms and by electronic means. In many ATOs these changes require a considerable amount of instructor training. Most instructors will enjoy the challenges of the core flying skills phase because it requires them to deliver routine training in a new professional “style”.

Please refer also to the deliberations about “underpinning knowledge” in Section 9.

Phase 1 is *not* PPL training: Although this phase will mostly be flown in small single-engine airplanes and covers at least the content required of a PPL qualifying course, it is important not to confuse it with pure PPL training. MPL courses should be clearly differentiated from traditional PPL training.

Student confidence: It is important to brief the instructors on the important value of Phase 1, which is to build confidence in core flying skills. Training for confidence building is provided in a single-pilot environment

(single-pilot "work" in aircraft that are certificated for single-pilot operation) and should not be disrupted by any kind of simulated multi-crew cooperation. Upset prevention and recovery training (UPRT) plays a special and very important role in the process of confidence building. UPRT instructors therefore must be highly trained and qualified. ATOs should refer to the guidance provided in Section 5 of ICAO's Doc 10011, Manual on Aeroplane Upset Prevention and Recovery Training, on meeting the specialized training and qualification requirements for instructors assigned to provide UPRT to MPL students. UPRT should be provided at a stage of the MPL training in accordance with the approved MPL program and can be scheduled in any phase of the program.

VFR flight – Phase 1: As MPL cadets must reach the knowledge and skill levels required for the holder of a PPL, VFR flight must also be trained to this extent. Obtaining a PPL is not required for MPL students and a PPL skill test is not required.

IFR flight and night flight – Phase 1: An introduction to basic instrument flight and night flying is required in an airplane. This must not be confused with training for an instrument rating or a night privilege. During the later phases of the MPL course the students will receive additional and sufficient instrument training in simulators; therefore extensive approach training is not required in the core flying skills phase. Also, instructors should be relieved from the pressure to deliver a full instrument rating in Phase 1. The aim of the introduction to instrument flight is to provide the student with the realistic sensory impressions of actual flight under instrument conditions.

15.1.2 Training Aircraft in Phase 1

For MPL course designers, especially those planning a new MPL ATO operation, it is important to keep the primary objective of MPL (airline pilot training) firmly in mind from the start of training. Training aircraft should have appropriate flight decks. They should have 4-seater cabins – with students observing the training - as well as air-conditioning for very hot climates.

15.1.3 FSTDs in Phase 1

Adding training value

In accordance with sound ISD principles, MPL courses should augment Phase 1 by including FSTD lessons. Exercises can be pre-flown in the FSTDs, repeated in the air (possibly video recorded), and then debriefed using video replay.

15.2 Considerations in Phase 2 (Basic)

15.2.1 Instructors in Phase 2

FI and multi-crew experience, or SFI/TRI and FI or SFI/TRI and IRI.

15.2.1.1 Special Importance of Phases 2 and 3

There has been a tendency so far to focus on Phase 1 (core flying skills) and Phase 4 (advanced/type rating), undervaluing Phases 2 and 3. It is important to highlight the function of these two important phases, which is to introduce the whole scope of multi-crew operation and instrument flight in an environment similar to future airline operations, as early as possible. While TEM should be introduced from the start of an MPL program, Phase 2 is especially critical to the deeper development of the necessary competencies for airline operations in the multi-crew environment.

Normally, during Phase 1, flight instructors (FIs) are used and during Phases 3 and 4 TRIs or FSIs/SFIs are used. For Phase 2 the ATO must select multi-crew experienced instructors and train them thoroughly on the content of this phase. Phase 2 has the potential to be the most innovative part of an MPL course and in the conduct and effectiveness of competency-based training.

Phase 2 requires instructors who are able to combine basic and advanced instrument flight instruction targeted at typical airline operator flight crew environment. This could be FIs with robust multi-crew experience or TRIs/FSIs (or SFIs) with experience in basic and advanced instrument flight instruction. Already in Phase 2 instructors must be capable of teaching the whole set of core competencies used by the ATO from program-start and apply continuous assessment in the most learning-conductive way. An ideal instructor for Phase 2 could be an experienced First Officer from the partnering operator who is a FI or SFI/FSI and also at least rated for instrument rating instruction.

15.2.1.2 Training Aircraft in Phase 2

Due to the fact that small, propeller-driven, straight wing, single-pilot airplane are not multi-crew training devices (in conformity with the philosophy of the MPL), it is suggested that the design of an MPL course should provide for completion of single-pilot airplane training in Phase 1 and for UPRT. For reasons related to logistics and resource management, this may not be possible for an ATO, and some programs may need to “spread” the aircraft flight hours across Phases 1 and 2, which is allowed in MPL. However, if the on-aircraft flight phase can be completed in Phase 1, this will pave the way to start realistic multi-crew operational training from the beginning of Phase 2.

15.2.1.3 FSTDs in Phase 2

The ICAO and EASA MPL Training Schemes suggest the use of single and/or multi-engine airplanes in Phase 2 as well as FSTDs. This is not an ideal fit with the objective of early introduction of multi-crew operations.

Although training in Phase 2 can be generic, it is advisable to use an FSTD based on the flight model of an appropriate modern twin-engine, multi-crew transport/commuter category airplane. ICAO Annex 1 requires that the FSTD represents a turbine-powered airplane.

15.3 Considerations in Phase 3 (Intermediate)

15.3.1 Instructors in Phase 3

Type Rating Instructor (TRI), Synthetic Flight Instructor (SFI)/Flight Simulator Instructor (FSI)

15.3.1.1 FSTDs in Phase 3

MPL is a performance-outcome approach to training. The MPL competency framework should accommodate varying degrees of integration of FSTDs and should support the development of a training program in which appropriate aircraft and FSTDs are used to ensure optimal transfer of learning, enabling trainees to move seamlessly through different components of the learning environment to the work environment. The more the learning environment equates to the work environment the better. In this context it is obviously ideal, although not essential, to introduce the highest level of FSTD fidelity possible, resources permitting (Type VII). However, resources will limit this option in some ATOs.

15.3.1.2 Type-Specific FSTD in Phase 3 or Not?

MPL Phase 3 learning outcomes are not designed for the FSTD to be type-specific, it can be generic. While the highest fidelity FSTD (Type VII of Doc 9625, Volume I) type-specific to a multi-pilot aeroplane (MPA) would be the ideal FSTD, Type VI FSTD example indicated in the summary matrix for MPL Phase 3 training in ICAO Doc 9625 offers a means, but not the only means, by which the FSTD specifications support the training outcomes. In addition, the underlying task analysis indicates the possibility to meet competency outcomes by a combination of training in the Type V and Type VII FSTD examples. (REF: ICAO Doc 9625)

Note: ICAO Annex 1 – Personnel Licensing including guidance material and the EASA Part-FCL rules differ on the issue of FSTD characteristics to be applied to Phase 3.

15.4 Considerations in Phase 4 (Advanced)

15.4.1 Instructors in Phase 4

Type Rating Instructor (TRI), Synthetic Flight Instructor (SFI)/Flight Simulator Instructor (FSI), Type Rating Instructor (TRE).

15.4.1.1 FSTDs in Phase 4

MPL Phase 4 includes, but should not be limited to, an airplane type rating. The implication of receiving a type rating during Phase 4 may drive the ATOs toward simply preparing the student to successfully complete the qualifying check ride. This temptation must be avoided. CAA administered skill tests should not impact the intended training syllabus since the maneuvers required by check rides serve merely as a quality control process to give the Licensing Authority an appreciation of the applicant's ability to meet prescribed license-qualifying standards. The check ride is a very weak determinant of a pilot's overall capability to effectively deal with the operational environment of a modern-day airline. Phase 4 program has to delve into every facet of transport category airplane operations, including when the flight conditions become completely unfriendly, even right down to effectively managing the airplane when all the "magic" of the flight deck is unresponsive or has decided to take on a life of its own. Like the temptation to treat Phases 1 and 2 as nothing more than a glorified PPL program, do not allow the type rating requirement to unduly influence any of the training objectives of Phase 4. If robust ISD principles are adhered to in the design and delivery of the course, and the ATOs involved consistently employ sound quality assurance processes, the results of the training will consistently be outstanding.

An appropriate combination of device specifications to meet learning outcomes is indicated in the FSTD master matrix in ICAO Doc 9625, Volume I, Edition 4, Appendix C to PART I.

Note: Because of its volume, the FSTD master matrix is not part of this material, but the FSTD summary matrix is shown in Attachment 5 requiring training exclusively in a Type VII device, in compliance with Annex 1, Appendix 3, Paragraph 4[8].

It is suggested that, whilst the MPL training programs are being introduced and validated, the highest appropriate level devices be used to facilitate the safe and efficient implementation of the MPL requirements. Note that for modern type rating transitions many training organizations are already using lower level devices (ICAO Doc 9625 FSTD Type IV) prior to the students entering the full flight simulator (FFS, Doc 9625 Type VII). These transitions are proving most effective, and some are already competency-based. The use of a blend of devices has been a step-up in process because students enter the FFS fully conversant with SOPs. It may therefore not be considered necessary by an NAA to require FSTD Types VIIs exclusively for Phase 4 of MPL.

Important note: In cases where the FSTDs used in Phases 3 and 4 of an MPL program are type-specific corresponding to the type of airplane intended to be operated by the MPL graduate, the respective type rating training content should be distributed over both training phases.

[8] The Annex 1, Appendix 3 requires a Type IV device (as described in paragraph 4) that has been later on defined as a Type VII device in Doc 9625, Volume I, edition 3 and later editions. This discrepancy will be corrected in due time.

15.5 Base Training

The requirement for a certain number of exercises or hours to assure a certain competence is in contradiction to the principle of the competency-based approach to training. However, earlier industry inputs to the program lead to the current requirement for 12 takes-offs and landings with a conditional reduction to 6 in the ICAO PANS-TRG under the conditions described in paragraph 3.3.5[9] and with National Licensing Authority approval.

Note: The question whether some or all of the landings should be full stop landings with taxi back for take-off can be answered as follows: the distribution between touch and goes and full stop landings should be such that the student gains experience in the correct handling techniques from after touchdown until arriving at taxi speed to an extent necessary to assure sustained repetition.

15.5.1 Current Requirements and Conditions

ICAO: Alternatively, ICAO PANS-TRG recommends 12 take-offs and landings, but allows for a reduction to a minimum of 6 take-offs and landings subject to:

a) The approved training organization has demonstrated to the satisfaction of the Licensing Authority that it does not negatively affect the acquisition of the required skill by the student; and,

b) A process is in place to ensure that a corrective action can be taken if in-training or post-training evaluation indicates a need to do so. (PANS-TRG Paragraphs 3.3.4 and 3.3.5*)*

EASA: Under the current EASA Part-FCL requirement, a minimum of 12 take-offs and landings between MPL skill test and the IOE phase are required.

TCCA: Allows a reduction to 6 take-offs and landings if successfully meeting additional aircraft handling performance criteria.

CAAC: Requires a minimum of 20 take-offs and landings before entering the IOE phase.

[9] To become Part II, Section 1, 1.3.5 in edition 2 of PANS-TRG (applicable on 10 November 2016).

Section 16—Civil Aviation Authority Oversight and Approval

16.1 The Paradigm Shift

Multi-crew Pilot License (MPL) training programs represent a powerful new approach to developing ab-initio (no previous experience) civil aviation pilots to operate within a commercial air service. Its emphasis is on the effective application of competency-based training methodologies, representing a paradigm shift away from “traditional” training approaches. As a result, it is frequently misunderstood by many in the industry and Civil Aviation Authorities (CAAs) because of its complex course development and delivery methodologies, and the requirement to employ continuous assessment processes.

ICAO defines competency-based training and assessment as *“training and assessment that are characterized by a performance orientation, emphasis on standards of performance and their measurement, and the development of training to the specified performance standards.”* It is important to realize that these benchmarked standards of performance are derived from a comprehensive job and task analysis that is the foundation upon which the design and the delivery of such a program is scientifically determined. This process is known as "Instructional Systems Design" (ISD) and its application is recognized as being essential to ensuring the very best training results. Therefore, the overall objective of this type of training is the acquisition of all the skill, knowledge and attitude requirements to competently perform all the job-related assigned duties in a safe, efficient, and effective manner under all possible circumstances.

Changes to ICAO Standards and Recommended Practices have recognized competency-based training programs as an alternative way to gain civil aviation occupational qualifications. The Advanced Qualification Program (AQP) used extensively in North America has components that are focused on the achievement of targeted competencies. The same could be claimed by alternative training and qualification programs (ATQP) used by some air operators in other continents. But in so far as being singularly focused on the achievement of comprehensive benchmarked competency elements, a properly ISD-developed MPL training program is by far the most notable example in civil aviation training at this time (see Appendix E, to 2nd Edition of Doc 9841, and Doc 9868 for details). As readers delve more into this section of the manual, it should become clear that the MPL and its corresponding training processes are quite unlike what has traditionally been approved by CAAs to date.

16.2 Overarching Attributes of an MPL Training Program

An MPL program is a rigorous, continuous, and integrated four-phased training course designed so the ab-initio candidate can acquire the competencies needed to perform safely and efficiently the duties of an airline pilot. Throughout the training syllabus the focus is on the student's ability to consistently achieve benchmarked performance standards scientifically derived from a detailed task/job analysis of a commercial airline pilot operating a modern-day turbine-powered transport category airplane. This scientifically derived

task/job analysis often undergoes a reverse-engineering process to identify all the critical training objectives, from the commencement of training until the point where the MPL holder commences line indoctrination. A critical element in this training is the continuous development of desirable behaviors and management skills through the adaptation of the principles taught in Crew Resource Management (CRM) and Threat and Error Management (TEM) training. To consistently achieve all the desired outcomes necessitates a robust quality assurance system and a continuous evaluation process designed to immediately detect and effectively deal with either course or student performance deficiencies.

The development of such a performance-oriented syllabus requires an ISD approach with emphasis on defining progressive levels of individual competencies. This fosters a learning environment focused on the outcomes of each training event and the continuous improvement of student performance. To ensure the continued relevancy and desired outcomes of the training are being achieved, this type of program must be backed by an exacting validation process that will be heavily dependent upon both real-time training data analysis and follow-up airline feedback once the trainee enters the workforce. This should result in the continuous refinement of the training program.

16.3 Required Components of an MPL Training Program

In order to effectively introduce MPL training, Approved Training Organizations (ATOs), participating air operator certificate holders, and, in particular, the CAAs need to have a comprehensive understanding of the following underpinning attributes of such a highly-structured program:

- Instructional systems design (ISD) processes
- Program managing authority processes
- Quality assurance (QA) and, when applicable, safety management system (SMS) governance processes
- Learning management system (LMS) processes
- Program and learning dynamics
- Screening and selection processes, and
- Continuous assessment and outcomes analysis processes

Many of the aforementioned MPL training program attributes have been discussed in earlier sections of this manual. However, there are several elements of each that need to be addressed from an “evaluator’s” perspective. It becomes particularly significant when the assigned CAA inspector realizes that only recognizing the existence of regulatory-prescribed components for this type of training will simply be inadequate in granting course approval. With identified standards not based upon achieving quantifiable measurements, the approval and oversight of competency-based programs demands the effective and accurate evaluation of both the “outcomes” of each training objective and the training program itself. It also requires assessing the corresponding processes, which are designed to assure the continuous achievement of those objectives under all likely scenarios. For many CAAs, “outcomes/process” assessments represent a new challenge and should not be attempted without comprehensive preparatory training. Appendix G to 2nd Edition of Doc 9841 provides guidance dealing with additional training for CAA inspectors who face such a situation.

16.4 Instructional System Design Process – Assessment

ISD is a term used to identify a structured process for the methodical analysis, development and evaluation of a training system. While there are variants of the basic ISD model, each with its own labels to describe the process, PANS-TRG describes the ICAO learning design/delivery model as consisting of, as a minimum, an analysis, design and evaluation stage. Feedback loops are also a critical element of any ISD model and should be used to confirm assumptions or make adjustments when errors, omissions, or opportunities for improvement are discovered.

When presented with an application to conduct an MPL training program, the CAA should first determine if the program is underpinned by a comprehensive ISD process that can be reviewed to validate the details of the design and delivery of the program, and if its training objectives are based upon scientific principles. Furthermore, because ISD processes involve an evaluation stage, the CAA should consider initially granting only provisional approval to the applicant, until it can be determined that the desired outcomes of the proposed training program are consistently achieved and are likely to remain so (refer to PANS-TRG for specific details on ISD processes).

This ISD process should also be applied to the design and delivery of any instructor training program to ensure all instructors assigned to teach any aspect of an MPL program possess the specific knowledge and skill sets to effectively function in this highly specialized program. CAAs should carefully review the determination process used by the ATOs in setting their MPL instructor training standards. (*Chapter 6 of Doc 9868, 2nd Amendment*)[10]

16.5 Program Managing Authority Process – Assessment

Because of the potential sweeping scope of an MPL program, CAAs should carefully review their training program approval criteria and consider the need for a designated “Program Managing Authority”. Such an Authority would be recognized by the CAA as having overall responsibility for the content and fidelity of an authorized MPL training program. A single source with overall program responsibility becomes essential to an effective safety oversight program whenever any portion of MPL training might be conducted at more than one ATO location. Another example would be an MPL training provider who contracts out some elements (e.g., aeroplane upset prevention and recovery training (UPRT) or phases of the MPL training program, but remains the Program Managing Authority).

In addition to the responsibility identified above, the Program Managing Authority should assume responsibility for all MPL Training Program data reporting/analysis as well as data reporting/analysis required for the employment period following successful completion of the MPL training program.

[10] To become part 1, Chapter 3 in the second edition of Doc 9868

16.6 QA and SMS Governance Process – Assessment

The Standards and Recommended Practices (SARPs) contained in Annex 1 state that "*ATOs shall establish a quality assurance system, acceptable to the Licensing Authority granting the approval, which ensures that training and instructional practices comply with all relevant requirements*". Guidance to support this requirement is described in detail in the 2nd Edition of Doc 9841, the *Manual on the Approval of Training Organizations*. The requirement for an ATO to have an effective safety management system in place whenever the ATO is exposed to safety risks related to aircraft operations can be found in ICAO's Annex 19 — *Safety Management*.

The approval process for MPL training should include a re-evaluation of each affected ATO's documented policies, processes and procedures to confirm that participating ATOs have well-articulated and developed QA and, when applicable, SMS processes to deliver high quality MPL training. This re-evaluation should not be viewed simply as a "paper" exercise whereby the ATO submits a copy of its quality and safety manuals to the CAA for review. Determining each manual's regulatory compliance needs to take place; however, the CAA needs to also ensure that the policies, processes and procedures described in these documents are actually implemented, being used, and consistently being adhered to by all ATO personnel and, to the extent applicable, their clients.

16.7 Learning Management Systems (LMS) – Assessment

Competency-based training demands the continuous assessment of trainees against benchmarked performance standards. Additionally, ATOs need to ensure that the development and delivery of their training programs are captured by their quality assurance programs. These two fundamentals can sometimes be difficult to achieve when the ATOs' resources are limited. Consequently, competency-based training requires significantly well-structured learning management processes to be in place.

Although it is possible to manage the delivery of training with tools as simple as chalkboards, tracking sheets and training booklets, the necessities of this type of specialized training make it highly desirable to have a much more effective LMS in place.

An LMS is a system, or set of processes, designed to fulfil the following needs of a properly managed competency-based training program:

a) courseware control

b) documentation and record-keeping

c) student and instructor performance monitoring

d) tracking adherence to program design and approved improvements

e) standardization of delivery, and

f) data analysis

Regardless of the degree of its sophistication, a learning management system of one sort or another needs to be in place and assessed by the CAA as being effective in permitting the ATO to adequately manage the training program.

While there are different methods available, one thing worth pointing out to the ATO is that an LMS, if it is web-based and permits controlled access via secure Internet connection, could provide CAA inspectors with the ability to remotely observe trainee and course progress relative to the syllabus in near real time. This ability, while not required, may reduce the number of onsite evaluations required without reducing the degree of regulatory oversight, thereby improving efficiency for both the CAA and the ATO.

16.8 Program and Learning Dynamics – Assessment

Educational experts have long recognized that the compartmentalization of theory and skill training is not only inefficient, but it diminishes the ability of the student to logically determine the relevancies of the material being taught. The old approach of spending months taking theory in ground school before going to the flight line is the worst possible scenario in a performance-based learning environment. For this reason PANS-TRG states: *"Each phase of the MPL Training Scheme shall be composed of instruction in underpinning knowledge and in practical training segments. Training in the underpinning knowledge requirements for the MPL shall therefore be fully integrated with the training of the skill requirements."*

Competency-based training design and delivery methodologies respect the fact that the learning experience is different for each individual. In such an environment, remediation efforts addressing any course or individual performance deficiency from the benchmarked standard are ongoing. Unlike traditional approved training programs, students who fail to achieve the expected competency levels at the end of a particular lesson must not be permitted to advance further in the syllabus until they have successfully achieved the required levels. Hence the programs' design, often referred to as its footprint, must have the flexibility to respond to these situations. CAAs must require such flexibility and not approve overly rigid course schedules that may tend to impede the attainment of desired competencies, thus reducing the effectiveness of the training. ATOs should be capable to demonstrate the flexibility of their program and identify those documented processes that will come into play to facilitate timely remediation efforts.

16.9 Screening and Selection Process – Assessment

The importance of effective screening and selection cannot be overstated. The working environment of a modern civil aircraft cockpit is uniquely complex and known only to those who have experienced it. The early determination that MPL candidates are suitable, capable and sufficiently motivated to overcome the challenges and rigors of the training will be crucial to the ATO fielding a successful program. Each candidate should be selected through a well-designed screening process that will retain those applicants who show potential to graduate successfully from the MPL training program and meet the professional expectations of the airline associated with the MPL program for successful long-term employment and career progression.

It can be expected that many air operators will pre-screen and select trainees. Understanding and participating in the selection criteria the air operator uses, will provide the ATO with input into the selected trainee's aptitudes and ensure the thoroughness of the process. Every sponsoring air operator will have its own unique needs, but the underpinning character traits of an effective and safe professional pilot are almost universal. Ideally, the partnering air operator should select its trainees based on suitability for employment with the company, but work with the ATO to screen candidates for training. Regardless of who conducts the final selection, ideally both the ATO and the operator should be involved, an obvious benefit to effective screening will be a significantly increased success rate, and the near elimination of those candidates who might voluntarily withdraw from training. ATOs must be mindful though of the significant risks they assume if they are completely disengaged from their trainee's screening and selection activity.

It can be argued that given enough time and training anyone can be taught to fly an aircraft but the reality is that time is precious and training resources finite. Under a competency-based system, such as an MPL training course, progression is based on the mastery of required competencies. A trainee or an ATO will not have the luxury of unlimited training time. A carefully selected MPL trainee is one who can be expected to meet or exceed training demands within the course timeline imperatives, allowing for remediation training, if necessary, at some stage.

CAAs should be cognizant of the screening and selection process used in determining which candidates are appropriate for this type of training and subsequent employment with the partnering airline, and take it into account when approving the training program. They should also be assured that this process addresses the issue of English language skills and that those who begin their training with limited comprehension or communication skills will graduate having attained the ICAO-defined operational level of fluency.

The *IATA Guidance Material and Best Practices for Pilot Aptitude Testing Guidance* contains valuable information on screening and selection processes and is available at www.iata.org.

16.10 Continuous Assessment and Outcomes Analysis Process – Assessment

It should now be well understood that competency-based training requires continuous assessment of the trainee's progress as well as monitoring the performance of the instructors. This will ensure that throughout the program individuals are meeting the expected performance standards and that effective remediation efforts are put into place in a timely manner. But just as important is the need for the training program itself to be evaluated. Program evaluation is required by the ISD process and should be well documented in the ATOs' policy, processes and procedures. (Doc 9868 and Doc 9841 describe this in greater detail.)

ATOs should be able to demonstrate how they intend to effectively carry out these responsibilities and be able to report any corrective or preventive actions that were taken to improve the learning environment and its outcomes. CAAs should also be able to verify the existence of such processes in the ATO's QA manual and apprised of their implementation.

16.11 MPL-Qualifying Mastery Exams

At the time the MPL was first adopted by ICAO the highest knowledge standards to qualify for a pilot license were those identified as the requirements necessary for an Airline Transport Pilot License (ATPL). Consequently, Annex 1 currently requires that multi-crew pilot license applicants meet those same knowledge requirements. This standard should not be literally interpreted to mean that an applicant must successfully complete those same examinations originally designed by the State to be administered to airline transport pilot license applicants. Since holders of a multi-crew pilot license are expected to immediately enter into a commercial air operator's line-indoctrination program without "bridge" or supplemental training, CAAs may wish to review their existing examination requirements for the MPL because the current Annex 1 ATPL knowledge requirements were adopted when a pilot applying for an ATPL had significant flight exposure and experienced gradual career progression. The Annex 1 requirements are broad in nature and do not account for the ab-initio training program graduates' need to perform proficiently as pilot of turbine-powered transport category aeroplanes upon graduation. This analysis may suggest that it would be more beneficial to develop a separate set of qualifying knowledge examinations for the multi-crew pilot license. This could well provide CAAs with a more effective validation process, which more accurately identifies the existence of all those knowledge competencies needed for operating a modern transport category aeroplane in an international commercial air transport operation.

MPL training needs to use an integrated approach in which the training in the underlying knowledge to perform a task is followed by practice of the task so that the trainee effectively acquires the underlying knowledge, skills and attitudes related to the task. An MPL-specific set of qualifying mastery exams designed for this approach to learning would be optimum.

16.12 MPL Rulemaking

First, it needs to be understood that the objectives of outcomes-focused learning environments are often marginalized by regulatory structures that focus upon the composition requirements of a program rather than the attainment of desired objectives. Second, if the reduction of risks to safety and furthering the development of the air transport system are the overarching goals of the CAA, then achieving improved training *results* need to factor into that effort. Rule makers should understand that heavily prescribed and rigid regulatory structures tend to drive the aviation training community toward achieving success in meeting quality control testing criteria established by the CAA, instead of meeting the outcomes desired by the system and the trainees alike.

The establishment of performance-based learning environments is designed to overcome the debilitating effects of undergoing traditional training. Traditional training is largely derived from the need to meet the imperatives prescribed through regulation, rather than the needs of the individual and the work environment. Therefore, it is highly unlikely that existing regulatory structures governing traditional training programs will be a good fit for the MPL, or any other competency-based training program. These are programs that are focused upon achieving progressive benchmarked standards of performance leading to a desired end-state objective. To that end, CAAs should consider introducing a more performance-based framework of rules that support industry's efforts to achieve excellence in product and service delivery. This can be accomplished

by mandating the continued maintenance of effective governance processes to assure the achievement of stated objectives in training, rather than prescribing burdensome program ingredients and arbitrarily-arrived-at experience requirements. In order to achieve consensus during the MPL adoption process, ICAO had to adopt a number of quantitative imperatives in the standards and procedures governing the MPL and its training programs, such as Annex 1, 2.5.3.1: *"The applicant shall have completed in an approved training course not less than 240 hours as pilot flying and pilot not flying of actual and simulated flight"*. The consequence is that published minimum acceptable standards have driven some training organizations to adopt them in the development of their programs, excluding what the outcomes of a properly conducted ISD design and delivery process might have revealed. In order to meet all the international criteria established for MPL training, CAAs must insist that the applicants wishing to conduct MPL training demonstrate that the ISD process scientifically validates their program's construct, content and its duration before interim approval to conduct a proof of concept trial can be granted.

16.13 MPL Proof of Concept Trial

Only ATOs that have successfully demonstrated they possess and utilize effective QA and if applicable, SMS policies, processes and procedures, should be permitted to seek authorization to conduct MPL training. ATOs intending to participate in any form of MPL training should be carefully screened by the CAA for their suitability to run such a highly specialized program. Regardless of whether the MPL program has been successfully conducted by others in the past, each new ATO should only be granted provisional authority to conduct the program under a proof of concept trial. (Guidance can be found in Appendices E and F to Doc 9841.)

16.14 MPL Advisory Boards

In keeping with ICAO recommendations, CAAs should convene and chair an MPL Advisory Board in order to remain engaged with all principal stakeholders in the on-going development of the MPL regulatory environment. The board should review data and reports of current MPL activity and make recommendations to the decision makers within the CAA with the sole aim of improving existing MPL regulations and those policies promulgated through various manuals and departmental staff instructions.

Advisory Boards have been established by European Aviation Safety Agency (EASA), Transport Canada Civil Aviation (TCCA) and Qatar Civil Aviation Authority (QCAA). While these boards are very useful for some CAAs and regional agencies (e.g., EASA), a less formal set-up can be effective where MPL implementation is not wide-ranging, as long as all stakeholders have meaningful inputs to help steer the CAA's decisions.

16.15 ICAO Multi-Crew Pilot Symposium – 2013

To prove the concept of this new approach to ab-initio civil pilot training, ICAO has encouraged Contracting States to ensure proper implementation of the MPL by establishing seamless communication and exchange

of experience during the implementation phase of MPL around the globe, and to feed the results into the ICAO MPL "Proof of Concept" mechanism to facilitate a global exchange of best practices and continuous improvement. Furthermore, in view of the developmental nature of the first MPL course at each ATO, ICAO strongly urged States to grant initial provisional approval only to carefully selected ATOs, which in turn could be confirmed after obtaining satisfactory results that were deemed to be repeatable.

By means of State Letters (2007 and 2013), ICAO requested States to collect and provide data about MPL training courses by completing questionnaires with data for MPL national regulatory implementation and CAA MPL inspectors, each approved MPL training program, MPL class and individual trainee, including graduate data covering the early operational experience and evaluation from the operators associated with the MPL program.

The first ICAO MPL Symposium was held in Montreal on 10–12 December 2013. During this symposium the breakdown of data sets from 15 MPL programs incorporating about 600 individual MPL graduates was discussed. Upon review, it was determined that the proof of concept is sound and meets expectations. The following specific areas were identified as requiring further action*:

- Under the auspices of ICAO, improve and intensify the MPL data collection and analysis mechanism including upgrade to Captain position (work in progress).
- Review theoretical knowledge delivery and testing.
- Review and clarify the competency concept in PANS-TRG (work in progress).
- Develop, through this publication, IATA-IFALPA co-branded implementation guidance material harmonized with ICAO, including guidance on the course approval process.
- Review and mature Simulated ATC Environment (SATCE) requirements, encourage more widespread development and testing of SATCE in FSTDs, identify and promote effective alternate means of compliance for ATC environment simulation, given current technical limitations (SATCE in FSTDs was not meeting those criteria initially outlined in ICAO Doc 9625 (Ed 3), and training in ATC communication skills was consistently identified as a challenge and area where improvement was necessary) – upgraded SATCE guidance is published in Doc 9625, Volume I, edition 4 – 2015.
- Review the prescriptive FSTD qualification for Phases 2 and 3 - *"An Acceptable Means of Compliance should be to use FSTDs fit for the training purpose using Doc. 9625, Part III 'a la carte' option"* – this would imply an amendment to Annex 1, Appendix 3, paragraph 4.
- Review the requirements for Base Training (T/O and Landings) at the end of Phase 4. Review the requirements for instructor qualification, especially for Phase 2 (addressed to existing regional/national prescriptive qualifications).
- Address the license restriction for MPL graduates (specifically addressing an EASA issue).

**Refer to Attachment 8 "Results from MPL Symposium"*

Note: ICAO MPL Symposium Agenda, proceedings, presentations and a short report video called "Results from ICAO's 2013 MPL Symposium" can be found on the ICAO website at http://www.icao.int.

16.16 MPL Base Training Performance Feedback

Data collected by ICAO for the MPL symposium held in Montreal on 10-12 December 2013 included the number of take-offs and landings on type performed by about 600 MPL graduates. The average number of take-offs and landings overall was 14, but there were some ATOs performing just the absolute minimum required number (some down to the PANS-TRG minimum of 6). This was a sure sign of failing to train to competency unless a very advanced base training program preparation and validation can account for this, while other ATOs had a much wider range of numbers for take-offs and landings for their students, a necessary sign for demonstrating the training to competency concept. Some MPL students performed significantly more take-offs and landings to achieve competency, up to 36 (in an individual ATO case). Some CAAs require more than the PANS-TRG minimum number of take-offs and landings (e.g., China currently requires 20 take-offs and landings) pending validation that lower numbers are acceptable. The conclusion from the data and the symposium was that the PANS-TRG provisions seemed to be validated by the collected data.

Section 17—Regulatory Status

This section summarizes how some major regulators of the world have transposed ICAO MPL Standards, procedures and guidance material into their own requirements as of our publication date.

The table below lists all States which have adopted MPL regulations:

States which have adopted MPL regulations	
Armenia	Malaysia
Australia	Maldives
Austria	Malta
Belgium	Netherlands
Brazil	Norway
Bulgaria	Pakistan
Canada	Philippines
Chile	Poland
China / China Hong Kong	Romania
Czech Republic	Portugal
Croatia	Qatar
Cyprus	Russian Federation
Czech Republic	Singapore
Denmark	Slovakia
Egypt	South Africa
Estonia	Spain
Ethiopia	Sri Lanka
Finland	Slovenia
France	Sweden
Germany	Switzerland
Ghana	Syrian Arab Republic
Greece	Thailand

States which have adopted MPL regulations	
Hungary	The former Yugoslav Republic of Macedonia
Iceland	Togo
Ireland	Ukraine
Italy	United Arab Emirates
Japan	United Kingdom
Jordan	
Latvia	
Lithuania	
Luxembourg	

17.1 ICAO

The basis of National Regulations:

- ICAO Annex 1 (10th edition): section 2.5, Appendix 2 and 3 and Attachment B
- PANS-TRG (Doc 9868) First Edition, Amendment # 3 from 13 November 2014

Note: PANS-TRG is complementary to the Standards and Recommended Practices (SARPS) of Annex 1 and provides procedures for a harmonized implementation of the multi-crew pilot license.

PANS-TRG is more than just guidance material; it is recommended to States for worldwide application and thus has a higher level of adherence for States. It will be amended subject to sufficient experience with the new kind of training. Eventually parts of PANS-TRG may enter into Annex 1 as SARPS on condition, once mature.

(ICAO Material is available for sale on www.icao.int).

17.2 JAA

Joint Aviation Authorities (JAA) has been an associated body of the European Civil Aviation Conference (ECAC) representing the European Civil Aviation Regulatory Authorities.

With the support of the European Authorities, JAA drafted many JARs (Joint Aviation Regulations) which were accepted (sometimes with changes) by the European States.

Among those JARs is JAR-FCL 1 which in Amendment 7 contains MPL requirements. JAR-FCL 1 including Amendment 7 is **transposed into EASA Part-FCL**

17.3 EASA

The European Aviation Safety Agency (EASA) develops common aviation safety rules at the European level (Basic Regulation: European Commission No 216/2008).

Implementing Rules (IRs), Acceptable Means of Compliance (AMCs) and Guidance Material (GM) for Flight Crew Licensing and Training have been implemented and are in the process of being further developed.

The EASA PART-FCL came into effect on 8 April 2013.

The Notices of Proposed Amendments (NPAs) have gone through an extensive comment phase and a Comment Response Document (CRD) was published after a short second comment period. The final result – called "EASA Opinion PART-FCL" – was presented to the European Commission in August 2010.

EASA Part-FCL (Pilot Licensing) includes MPL under Subpart E and closely follows (except for the JAR requirement for an MPL Advisory Board) the relevant regulation in JAR-FCL Subpart K. Nevertheless, this MPL Advisory Board is continued by EASA and has been renamed European MPL Advisory Board.

Additional EASA requirements exceeding ICAO Annex 1 and PANS-TRG:

1. **Instructors** (See also Section 10, *Instructor Qualification*):

   All instructors must successfully complete an MPL Instructor Training course.

   (See Attachment 4 – MPL Instructor Training Course)

   For Flight Instructors (not TRI or SFI) in the basic phase, an experience of at least 1500 hrs. in multi-pilot operations is required. The multi-pilot experience requirement can also be met by a structured course of training (consisting of MCC qualification and 5 observer sessions in the intermediate phase of an MPL course, 5 observer sessions in the advanced phase, observations of 5 operator recurrent LOFT sessions, the content of the MCC instructor course, with his/her first 5 instructor sessions being supervised by a TRI and a final assessment).

   To maintain the MPL-instructor qualification the instructor shall, within the last 12 months, have conducted at least a simulator session of three hours or a one-hour air exercise with two take-offs and landings; refresher training must be performed in case revalidation is necessary.

2. **Arrangement between ATO and Operator**

   MPL Training courses shall only be authorized if the Approved Training Organization (ATO) belongs to a certificated commercial air transport operator or has a specific arrangement with such an operator.

3. **FSTD fidelity in Phase 3**

   Phase 3 training requires a Level B simulator.

4. **Simulated ATC Environment** (See Section 14).

5. **The Take-offs and Landings (Base Training)** to finish the Advanced Phase (See Section 15).

17.4 CAAC

Civil Aviation Administration of China

For the time being MPL-training is regulated in AC-61- -2012-13R1 and mainly based on ICAO Annex 1, PANS-TRG (Doc 9868) and JAR-FCL Amendment 7 Subpart K and the relevant Appendix. Finally, the regulation will be integrated into CCAR 61.

Additional CAAC requirements exceeding ICAO Annex 1 and Doc 9868:

- For **instructors in the elementary part of the basic phase** (15 hrs actual flying in a high performance airplane) **experience of at least 1500 hrs in multi-pilot operations, an instrument instructor rating and a type rating on the relevant high performance airplane is required.**
- All instructors must perform an **MPL instructor course** including MCC training and three observer sessions in the intermediate and advanced phase and during loft training and line flying with a final assessment on completion.
- If not fulfilling the **MPL instructors recurrent requirements** (a simulator session of three hours or a one hour air exercise with two take-offs and landings), a refresher training must be performed.
- Training is increased from a minimum of 240 hours to a minimum of **340 hours**, with at least **110 hours in actual flight**.
- **Implementation monitoring** by CAAC through supervision and the exchange of information between the Authority, ATO and operator being involved in the MPL training takes place.
- **Base Training requires a minimum of 20 TOs/LDGs.**

17.5 FATA

Federal Air Transport Agency of Russia (Rosaviatsia)

See: www.ruaviation.com The regulation is in the Russian language.

17.6 CASA

Civil Aviation Safety Authority, Australia.

MPL regulations are in Civil Aviation Order (CAO) 40.1.8 and Civil Aviation Advisory Publication (CAAP) 5.216-1(0) MPL (aeroplane).

See: www.casa.gov.au

Additional CASA requirements exceeding ICAO Annex 1 and Doc 9868:

- A special **MPL instructor course** in MCC, TEM and CRM and suitable experience in multi-pilot operation
- **Achievement records** to document continuous assessment
- **Implementation monitoring** by CASA through supervision and exchange of information between the Authority, ATO and operator being involved in the MPL training

There is no requirement for **the simulation of ATC environment**

17.7 QCAA

Qatar Civil Aviation Authority

QCAR-FCL1 from 2007 is based on JAR-FCL Amendment 7 (available on the Internet)

No deviations.

17.8 CAAS

Civil Aviation Authority of Singapore

Relevant SASP from 2010 (Singapore Aviation Safety Publications) are based on JAR-FCL1

Deviations: Base Training (T/O and landings) can be reduced to six

17.9 TCCA

Transport Canada Civil Aviation

See: www.tc.gc.ca MPL Training Program Guide – Flight Training and MPL Knowledge Objectives and Study Reference Guide.

Additional TCCA requirements exceeding ICAO Annex 1 and Doc 9868:

- A well specified **grading system**.
- All ATOs have to undergo **a beta testing process**, even if the proposed MPL syllabus has already proven to be effective in producing the desired results in another ATO.

- Airlines have to provide data on the graduate's performance to the ATOs covering a period of at least one year and no less than 2 proficiency checks. The ATOs have to analyze the data and keep respective records.
- Since at the time of rulemaking there was no adequate system commercially available, there is currently no requirement for **the simulation of ATC environment**.
- TCAA requires a minimum of **6 take-offs and landings** (BT) in phase 4 but includes additional aircraft handling exercises to be performed to prescribed standards.

17.10 CAD Hong Kong (HKCAD)

Civil Aviation Department Hong Kong, China.

See: www.cad.gov.hk CAD 54 Part 3 Chapter 14.

Additional HKCAD requirements exceeding ICAO Annex 1 and Doc 9868 [placed on the first Beta Trial: OAA and Dragonair]

- A requirement for the student to attain and **be issued with a PPL** to enable BT on MPA
- A requirement **to comply with existing initial twin and instrument ratings** via a twin-engine light training aircraft

17.11 GCAA

General Civil Aviation Authority, UAE.

See: www.gcaa.ae

Civil Aviation Advisory Publication (airplane) 37 (CAAP 37), effective date 1st August 2010 provides information and GCAA policy regarding the multi-crew pilot license.

CAAP 37 is based on reference documentation in existence and publications from ICAO, the JAA and EASA.

There are no deviations from ICAO Annex 1 SARPS or additional requirements.

17.12 Guidance for Implementation of MPL Regulation into National Regulation

ICAO Annex 1 and PANS-TRG (Doc 9868) are not designed to be directly transferred (copied) into national regulations. Annex 1 includes the minimum requirements and recommended practices (SARPs) and is

intended as an advice to States to draft their regulations. If the State's regulation differs from the standards of Annex 1 the State has to file a difference.

Copying parts of ICAO Annex 1 and /or the PANS-TRG is not sufficient. Even copying the appropriate regulation of other States or JAA/EASA is not the right course of action. It is important that these regulations correspond to the basic aviation law of the relevant State and must be appropriately adapted.

It is also most likely that many detailed requirements are not applicable or do not correspond with the situation in the relevant State, e.g., EASA Part-FCL contains some paragraphs that regulate the jurisdiction for training outside EASA States. Some requirements are unnecessarily complicated and could be more practicable but are based on a compromise between the European States.

Attachment 1–Global Status of MPL Implementation

1.1 Global Regulatory Status of MPL Implementation

The table below provides information on which States have adopted MPL regulations, have approved MPL training courses and which ATOs and operators perform the courses.

Global regulatory status of MPL implementation (January 2015)		
States which have adopted MPL regulations	**States which have approved MPL Courses**	**ATO/Operator**
Armenia		
Austria	X	Aeronautx/FlyNiki
Australia	X	Alteon/Xiamen Airlines (2006-2009)
Belgium		
Brazil		
Bulgaria		
Canada	X	CAE/Air Asia (until end of 2012)
Chile		
China	X	CAFUC/ Air China, China Eastern Airlines, China Southern Airlines
Croatia		
Cyprus		
Czech Republic		
Denmark	X	CAPA/Sterling (2006-2009)
Estonia		
Ethiopia	X	Fligthpath/Ethiopian Airlines
Finland		
Germany	X	a) LFT/Lufthansa, German Wings, City Line b) TFC-Kaeufer/Air Berlin, Condor
Ghana		
Greece		
Hong Kong	X	CAE-OAA/Dragonair

Global regulatory status of MPL implementation (January 2015)		
States which have adopted MPL regulations	**States which have approved MPL Courses**	**ATO/Operator**
Hungary		
Iceland		
Ireland		
Italy		
Japan	X	a) LFT/ANA b) CAE/JAL
Jordan		
Latvia		
Lithuania		
Luxembourg		
Malaysia	X	CAE/Air Asia (from 2013 onwards)
Maldives		
Malta		
Netherlands	X	Stella Aviation/Flybe
Norway		
Pakistan		
Philippines	X	Alpha Aviation/Cebu Pacific
Poland		
Portugal		
Qatar	X	a) CTC/Qatar Airways b) QAC/Qatar Airways c) STAA/Qatar Airways
Romania		
Russia		
Singapore	X	a) STAA/Tiger Air b) CAE-OAA/Tiger Air
Slovakia		
Slovenia		

Global regulatory status of MPL implementation (January 2015)		
States which have adopted MPL regulations	**States which have approved MPL Courses**	**ATO/Operator**
Spain		
Sweden	X	L.U.S.A/Avia Express, City Airline, Norwegian Air Shuttle
Switzerland	X	SAT/SWISS Int. Airlines
Syrian Arab Republic		
Thailand	X	TFT/Thai Airways
Togo		
Ukraine		
United Arab Emirates	X	Alpha Aviation/Air Arabia Etihad Flight Academy/Etihad
United Kingdom	X	a) CAE-OAA/Flybe b) FTE/Flybe c) CTC/Monarch Airlines, EasyJet, Virgin Atlantic d) FTE/BA-CityFlyer

1.2 Global MPL Course Tracker

The Global MPL Course Tracker contains the characteristics of all MPL courses around the globe. It is frequently updated, in line with the ramp up of MPL training. Therefore, it is provided in a separate file which can be downloaded from the www.iata.org/itqi website.

Attachment 2–Checklist for MPL Courses

Operators/ATOs can use this checklist to assess the success-critical areas of an MPL program.

Key program elements		Answers
ISD process	Done in house or consulted external expertise	
English language proficiency	How is it assured / assessed	
QMS / SMS	developed / approved	
All other course documentation (OM / TM)	developed / approved	
PAT	Who is responsible	
	Which institution performs the PAT	
	IATA PAT Manual in use	
Instructors, especially for Basic Phase	Licenses and ratings, availability	
	Experience in multi-crew environment, standardization	
Grading System	Core Competencies used for grading (for example ICAO Doc 9995 – EBT or existing Core Competencies from operator)	
	Grade sheets for MPL training course harmonized with grade sheets from Base Training and IOE	
	Grade sheets harmonized for all Phases of MPL training course (Core flying skills to Advanced Phase)	
MPL Learning Management System	Computerized database in place to continuously: • Record student performance in all MPL phases and IOE • Report training outcome • Facilitate learning • Validate the *NORM* • Validate behavioral indicators • Evaluate and improve course quality	

Key program elements		Answers
Data feedback system	Established between operator and PAT provider	
	Established between operator and ATO	
	Between operator/ATO and regulator	
FSTDs including simulated ATC environment (SATCE)	FSTDs arrangements for all phases Locations, contracts, approvals in place	

Attachment 3–Core Competencies

3.1 ICAO Definition of Core Competencies

A group of related behaviors, based on job requirements, which describe how to operate modern multi-crew transport airplane safely, effectively and efficiently. They describe what proficient performance in all phases of flight operation looks like. They include the name of the competency, a description, and a list of behavioral indicators.

3.2 Categories of Core Competencies – An Example

The following core competencies are an example set contained in ICAO Doc 9995, the *Manual of Evidence-based Training*, for a pilot to operate a multi-crew aircraft safely and efficiently and to effectively apply threat and error management. The behavioral indicators of the various categories of competencies were developed for the pilots of commercial air transport multi-crew aircraft. However, they can be applied to all pilots where the individual indicator is applicable to the specific operational environment.

Competency	Competency Description	Behavioral indicator
Application of Procedures	Identifies and applies procedures in accordance with published operating instructions and applicable regulations, using the appropriate knowledge.	• Identifies the source of operating instructions • Follows SOP's unless a higher degree of safety dictates an appropriate deviation • Identifies and follows all operating instructions in a timely manner • Correctly operates aircraft systems and associated equipment • Complies with applicable regulations • Applies relevant procedural knowledge
Communication	Demonstrates effective oral, non-verbal and written communications, in normal and non-normal situations.	• Ensures the recipient is ready and able to receive the information • Selects appropriately what, when, how and with whom to communicate • Conveys messages clearly, accurately and concisely • Confirms that the recipient correctly understands important information • Listens actively and demonstrates understanding when receiving information • Asks relevant and effective questions

Competency	Competency Description	Behavioral indicator
		• Adheres to standard radiotelephone phraseology and procedures • Accurately reads and interprets required company and flight documentation • Accurately reads, interprets, constructs and responds to datalink messages in English • Completes accurate reports as required by operating procedures • Correctly interprets non-verbal communication. • Uses eye contact, body movement and gestures that are consistent with and support verbal messages
Aircraft Flight Path Management, automation	Controls the aircraft flight path through automation, including appropriate use of flight management system(s) and guidance.	• Controls the aircraft using automation with accuracy and smoothness as appropriate to the situation • Detects deviations from the desired aircraft trajectory and takes appropriate action • Contains the aircraft within the normal flight envelope • Manages the flight path to achieve optimum operational performance • Maintains the desired flight path during flight using automation whilst managing other tasks and distractions • Selects appropriate level and mode of automation in a timely manner considering phase of flight and workload • Effectively monitors automation, including engagement and automatic mode transitions
Aircraft Flight Path Management, manual control	Controls the aircraft flight path through manual flight, including appropriate use of flight management system(s) and flight guidance systems.	• Controls the aircraft manually with accuracy and smoothness as appropriate to the situation • Detects deviations from the desired aircraft trajectory and takes appropriate action • Contains the aircraft within the normal flight envelope • Controls the aircraft safely using only the relationship between aircraft attitude, speed and thrust • Manages the flight path to achieve optimum operational performance • Maintains the desired flight path during manual flight whilst managing other tasks and distractions • Selects appropriate level and mode of flight guidance systems in a timely manner considering phase of flight and workload

Competency	Competency Description	Behavioral indicator
		• Effectively monitors flight guidance systems including engagement and automatic mode transitions
Leadership and Teamwork	Demonstrates effective leadership and team working.	• Understands and agrees with the crew's roles and objectives. • Creates an atmosphere of open communication and encourages team participation • Uses initiative and gives directions when required • Admits mistakes and takes responsibility • Anticipates and responds appropriately to other crew members' needs • Carries out instructions when directed • Communicates relevant concerns and intentions • Gives and receives feedback constructively • Confidently intervenes when important for safety • Demonstrates empathy and shows respect and tolerance for other people • Engages others in planning and allocates activities fairly and appropriately according to abilities • Addresses and resolves conflicts and disagreements in a constructive manner • Projects self-control in all situations
Problem Solving and Decision Making	Accurately identifies risks and resolves problems. Uses the appropriate decision-making processes.	• Seeks accurate and adequate information from appropriate sources • Identifies and verifies what and why things have gone wrong • Employ(s) proper problem-solving strategies • Perseveres in working through problems without reducing safety • Uses appropriate and timely decision-making processes • Sets priorities appropriately • Identifies and considers options effectively • Monitors, reviews, and adapts decisions as required • Identifies and manages risks effectively • Improvises when faced with unforeseeable circumstances to achieve the safest outcome
Situation Awareness	Perceives and comprehends all of	• Identifies and assesses accurately the state of the aircraft and its systems

Competency	Competency Description	Behavioral indicator
	the relevant information available and anticipates what could happen that may affect the operation.	• Identifies and assesses accurately the aircraft's vertical and lateral position, and its anticipated flight path • Identifies and assesses accurately the general environment as it may affect the operation • Keeps track of time and fuel • Maintains awareness of the people involved in or affected by the operation and their capacity to perform as expected • Anticipates accurately what could happen, plans and stays ahead of the situation • Develops effective contingency plans based upon potential threats • Identifies and manages threats to the safety of the aircraft and people • Recognizes and effectively responds to indications of reduced situation awareness
Workload Management	Managing available resources efficiently to prioritize and perform tasks in a timely manner under all circumstances.	• Maintains self-control in all situations • Plans, prioritizes and schedules tasks effectively • Manages time efficiently when carrying out tasks • Offers and accepts assistance, delegates when necessary and asks for help early • Reviews, monitors and cross-checks actions conscientiously • Verifies that tasks are completed to the expected outcome • Manages and recovers from interruptions, distractions, variations and failures effectively

Note: Demonstration of the core competencies can be assessed using the behavioral indicators, which should meet the required level of performance.

Attachment 4–Example MPL Instructor Training Course

The MPL instructor must be trained to understand both airline and ab-initio training objectives. The selection and training of MPL instructors should, in general terms, include the following considerations:

The MPL FI must be trained to understand both airline and ab-initio training objectives, and should enter the system via:

- Careful selection, in order to secure high levels of motivation, empathy, disposition for the instructors role and the capability to instruct in a competency-based training environment;
- More attractive career paths and remuneration to enhance retention. Some airlines involve additionally qualified First Officers and Captains in the MPL program as instructors (this may even include an operator seniority number); and
- Effective MPL instructor training / retraining, including competency-based instructional skills.

4.1 MPL Regulations

ICAO: The procedures in PANS-TRG Chapter 6 and the Attachment to Chapter 6[11] describe competencies for instructors and a framework for MPL instructor qualifications.

EASA: European regulations are more descriptive. *EASA PART-FCL material (See below)* provides an example on how to prepare instructors for their role. The main focus of this course is on familiarization of instructors with MPL regulations, competency-based training and threat and error management.

4.2 FCL.925 – Additional Requirements for Instructors for the MPL

a) Instructors conducting training for the MPL shall:

1. Have successfully completed an MPL Instructor Training course at an approved training organization; and
2. Additionally, for the basic, intermediate and advanced phases of the MPL integrated training course:
   i. Be experienced in multi-pilot operations; and
   ii. Have completed initial crew resource management training with a commercial air transport operator

[11] To become Part I, Chapter 3 and the Attachment to Chapter 3 in the 2nd edition of PANS-TRG (applicable on 10 November 2016).

b) MPL instructors training course

1. The MPL Instructor Training course shall comprise at least 14 hours of training.

   Upon completion of the training course, the applicant shall undertake an assessment of instructor competencies and of knowledge of the competency-based approach to training.

2. The assessment shall consist of a practical demonstration of instruction in the appropriate phase of the MPL training course. This assessment shall be conducted by an instructor examiner qualified in accordance with Subpart K.

3. Upon successful completion of the MPL training course, the approved training organization shall issue an MPL instructor qualification certificate to the applicant.

c) In order to maintain the privileges the instructor shall have, within the preceding 12 months, conducted within an MPL training course:

1. 1 simulator session of at least 3 hours; or

2. 1 air exercise of at least 1 hour comprising at least 2 take-offs and landings

d) If the instructor has not fulfilled the requirements of (c), before exercising the privileges to conduct flight instruction for the MPL he/she shall:

1. Receive refresher training at an approved training organization to reach the level of competence necessary to pass the assessment of instructor competencies; and

2. Pass the assessment of instructor competencies as set out in (b)(2).

4.3 AMC No 1 to FCL.925 – MPL Instructor Course

a) The objectives of the MPL instructors training course are to train applicants to deliver training in accordance with the features of a competency-based approach to training and assessment.

b) Training should be both theoretical and practical. Practical elements should include the development of specific instructor skills, particularly in the area of teaching and assessing threat and error management and CRM in the multi-crew environment.

c) The course is intended to adapt instructors to conduct competency-based MPL training. It should cover the items specified below.

4.3.1 Theoretical Knowledge

a) Integration of operators and organizations providing MPL training:

1. Reasons for development of the MPL

2. MPL training course objective

3. Adoption of harmonized training and procedures

4. Feedback process

b) The philosophy of a competency-based approach to training: principles of competency-based training.

c) Regulatory framework, instructor qualifications and competencies:

1. Source documentation
2. Instructor qualifications
3. Syllabus structure

d) Introduction to Instructional Systems Design methodologies (see ICAO PANS-TRG Doc 9868):

1. Analysis
2. Design and production
3. Evaluation and revision

e) Introduction to the MPL training scheme:

1. Training phases and content
2. Training media
3. Competency units, elements and performance criteria

f) Introduction to human performance limitations, including the principles of threat and error management and appropriate countermeasures developed in CRM:

1. Definitions
2. Appropriate behaviors categories
3. Assessment system

g) Application of the principles of threat and error management and CRM principles to training:

1. Application and practical uses
2. Assessment methods
3. Individual corrective actions
4. Debriefing techniques

h) The purpose and conduct of assessments and evaluations:

1. Basis for continuous assessment against a defined competency standard
2. Individual assessment
3. Collection and analysis of data
4. Training system evaluation

4.3.2 Practical Training

a) Practical training may be conducted by interactive group classroom modules, or by the use of training devices. The objective is to enable instructors to:

1. Identify behaviors based on observable actions in the following areas:
    i. Communications
    ii. Team working
    iii. Situation awareness
    iv. Workload management
    v. Problem solving and decision making
2. Analyze the root causes of undesirable behaviors
3. Debrief students using appropriate techniques, in particular:
    i. Use of facilitative techniques
    ii. Encouragement of student self-analysis
4. Agree on corrective actions with the students
5. Determine achievement of the required competency

4.4 AMC No 2 to FCL.925 – [MPL Instructor's] Renewal of Privileges: Refresher Training

a) Paragraph (d) of FCL.925 determines that if the applicant has not complied with the requirements to maintain his/her privileges to conduct competency-based training, he or she shall receive refresher training at an approved training organization to reach the level of competence necessary to pass the assessment of instructor competencies. The amount of refresher training needed should be determined on a case-by-case basis by the Approved Training Organization, taking into account the following factors:
    1. The experience of the applicant
    2. The amount of time elapsed since the last time the applicant has conducted training in an MPL course. The amount of training needed to reach the desired level of competence should increase with the time lapsed. In some cases, after evaluating the instructor, and when the time lapsed is very limited, the approved training organization may even determine that no further refresher training is necessary.

b) Once the Approved Training Organization has determined the needs of the applicant, it should develop an individual training program, which should be based on the MPL instructor course and focus on the aspects where the applicant has shown the greatest needs.

Attachment 5–FSTD Summary Matrix

This Attachment is extracted from the ICAO Document 9625 Edition 4, Manual of Criteria for the Qualification of Flight Simulation Training Devices.

DEVICE TYPE	LICENCE OR TYPE OF TRAINING	Train (T) or Train-to-Proficiency (TP)	DEVICE FEATURE											
			Flight Deck Layout & Structure	Flight model (Aero & engine)	Ground Handling	Aeroplane Systems	Flight Controls and Forces	Sound Cue	Visual Cue	Motion Cue	Environment - ATC	Environment - Navigation	Environment - Weather	Environment - Airports & Terrain
Type VII	MPL4 – Advanced	T + TP	S	S	S	S	S	R	S	R	S	S	R	R
	TR/ATPL	TP	S	S	S	S	S	R	S	R	S	S	R	R
	Re	T	S	S	S	S	S	R	S	R	N	S	R	R
	RL/RO/IO/CQ	TP	S	S	S	S	S	R	S	R	S	S	R	R
Type VI	MPL3 – Intermediate	T + TP	R	R	R	R	R	R	S	R1	S	S	R	R
Type V	TR/ATPL/RL/RO/IO	T	S	S	S	S	S	R	R	N	G	S	R	R
Type IV	MPL2 – Basic	T + TP	R	G	G	R	G	R	G	N	G	S	G	R
Type III	CR	T	R	R	R	R	R	G	R	N	N	S	G	G
Type II	IR	T	G	G	G	R	G	G	G	N	G	S	G	G
Type I	CPL	T	R	R	R	R	R	G	R	N	N	S	G	G(S)
	MPL1 – Core flying skills	T	R	R	R	R	R1	G	G	N	G	S	G	G
	PPL	T	R	R	R	R	R	G	R	N	N	S	G	R(S)

Feature Fidelity

G = Generic; R = Representative; S = Specific;

Type VI – MPL3 – Intermediate – Motion Cue – R1 = the pilot receives an effective and representative motion cue and stimulus, which provides the appropriate sensations of acceleration of the aeroplane 6 degrees of freedom. Motion cues should always provide the correct sensation. These sensations may be generated by a variety of methods which are specifically not prescribed. The sensation of motion can be less for simplified non-type specific training, the magnitude of the cues being reduced.

Type I – MPL1 – Core flying skills – Flight Controls and Forces – R1: aeroplane like, derived from class, appropriate to aeroplane mass. Active force feedback not required.

The Environment – ATC column is greyed out to indicate that this feature is currently under development.

Attachment 6–IATA Guidance Material and Best Practices for Pilot Aptitude Testing (PAT Manual)

This Attachment displays the Executive Summary of the IATA PAT Manual, published March 2012.

6.1 Executive Summary

Manual objective: to support all airlines. In recognition of the changing industry environment, this manual is designed to enable airline recruitment managers to implement modern practical pilot aptitude testing systems in their organizations. Operational decision makers, aiming to recruit the best candidates, face the dilemma of selecting between similar testing systems offered by various providers with varying document terminology. This manual should enable more informed selection.

Assumed Pilot Applicant Pool: A direct relationship between recruitment pool size and success of pilot aptitude testing (PAT) has been seen. The larger the recruitment pool, the better the PAT results. An adequate supply of pre-qualified and interested applications from which to select (for an airline career) are an assumed basis for this manual, which deals with selection and pilot aptitude testing. Initiatives to address a shrinking recruitment pool are beyond the scope of this manual.

Selection Systems: The term pilot aptitude testing is used as hyponym, overarching all areas of pilot selection, including aptitude diagnostics (basic abilities, specific/operational abilities, social competencies and personality traits).

Measurement dimensions: The primary measurement dimensions of pilot aptitude tests are:

a) Basic abilities (physical and mental)

b) Operational competencies

c) Social competencies

d) Personality traits

System performance: The performance of an aptitude testing system can be measured by an evaluation of the following factors:

a) Test reliability

b) Test validity (especially predictive validity)

c) Ratio of the selection rate (number off successes) versus hit rate (on-site success rate with regard to the test criterion)

Testing tools of choice: The least qualified testing instruments are freestyle interviews, while some of the higher qualified testing instruments involve psychometric testing. Classic flight-simulator checks are suitable to quantify the amount and type of training needed for selected personnel, and provide some confidence in the validity of previous experience, in case of ready-entry pilots, but they are not so suitable for testing aptitude. Simulation-based testing of operational competencies can be performed best on specifically programed (PC-based) low fidelity simulators, since they provide high values of predictive validity. Multi-stage testing systems (less expensive screening procedures first, costly selection procedures last) are most advisable.

Selection team and result: Hiring decisions should be made by a dedicated selection team. In the interest of safety and fairness and, assuming that the aptitude testing system has been professionally developed, implemented and validated, the hiring decision should be based solely on test results.

Regulatory issues: Medical examination, language proficiency and the ability to comprehend training course content are specific ICAO requirements for training. National regulators worldwide have been reluctant to develop guidance on personality, yet this criterion is most important for flight crew. There are some general guidelines for assuring the best psychological aptitude of applicants, but there is a lack of definitive material available. Equal opportunity legislation, data protection rules, legal provisions for professional aptitude testing and aspects of cultural diversity must be considered to ensure that ethical and legal aptitude testing is achieved.

Benefits: Professional aptitude testing for airline pilots, if correctly implemented, can contribute considerably to cost savings and enhanced safety for an airline. Selection is the first point of action, where no costs have yet been incurred, and improving this part of the process is critical to the avoidance of future risk and cost. The costs associated with implementing an effective aptitude testing system are significantly lower than subsequent costs of high failure rates resulting from immature selection. Benefits include enhanced safety, lower overall training costs, improved training and operational performance, more positive working environments, reduced labor turnover, and enhanced reputation of the airline brand.

Attachment 7–MPL Training Scheme

The table below is extracted from the ICAO Document 9868, Procedures for Air Navigation Services – Training, Amendment No.3 from 13 November 2014, Appendix 1 to Chapter 3[12].

<table>
<tr><th colspan="6">MPL Training Scheme
Minimum 240 hours of training including PF and PNF*</th></tr>
<tr><th colspan="2">Phase of training</th><th>Training Items</th><th colspan="2">Flight and simulated flight training media - Miinimum level requrement</th><th>Ground training media</th></tr>
<tr><td rowspan="4">Integrated TEM principles</td><td>Advanced

Type rating training within an airline-oriented environment</td><td>• CRM
• Landing training
• All weather scenarios
• LOFT
• Abnormal procedures
• Normal procedures</td><td>Aeroplane:
Turbine
Multi-engine
Multi-crew certified

FSTD:
Type IV</td><td>12 take-offs and landings as PF**

PF/PNF</td><td rowspan="4">• CBT
• E-learning
• Part-task trainer
• Classroom</td></tr>
<tr><td>Intermediate

Application of multi-crew operations in a high-performance, multi-engine turbine aeroplane</td><td>• CRM
• LOFT
• Abnormal procedures
• Normal procedures
• Multi-crew
• Instrument flight</td><td></td><td>PF/PNF</td></tr>
<tr><td>Basic

Introduction of multi-crew operations and instrument flight</td><td>• CRM
• PF/PNF complement
• IFR cross-country
• Upset recovery
• Night flight
• Instrument flight</td><td>Aeroplane:
Single or multi-engine

FSTD:
Type II</td><td>PF/PNF</td></tr>
<tr><td>Core Flying Skills

Specific basic single pilot training</td><td>• CRM
• VFR cross-country
• Solo flight
• Basic instrument flight
• Principles of flight
• Cockpit procedures</td><td>Aeroplane:
Single or multi-engine

FSTD:
Type I</td><td>PF/PNF</td></tr>
</table>

*PF – Pilot Flying; PNF – Pilot Not Flying (or pilot monitoring)

**Limited credit may be granted in accordance with special conditions (see PANS-TRG).

It is worth noting that the 4 phase structure is not cut in stone. It can be considered as an early model which may change as a result of further development of competency-based training.

[12] To become Part II, Section 1, Appendix 2 to Chapter 1 in the 2nd edition of PANS-TRG (applicable 10 November 2016).

With continuous developments in the field of FSTD technology and instructor training, it could very well be that future MPL schemes will not need any division into phases. It only needs to ensure that the novice-to-expert transfer follows the predetermined norm in all relevant competencies, based on a seamless continuous assessment of every training lesson (see further deliberations in Sec. 7).

Note: The FSTD Types I to IV in the table above correspond to the types in Annex 1, Appendix 3, § 4. Simulated Flight. Doc 9625, Volume I, uses a different numbering: Annex 1 Types I to IV correspond to Doc 9625 Types I, IV, VI and VII respectively.

Attachment 8–Results from ICAO MPL Symposium

(ICAO presentations Day1 and Day3 of the MPL Symposium 10-12 December 2013)

The following pages provide the content of the two presentations. Content that is modified or removed is identified by a comment in between brackets [ ].

8.1 [Day 1:] Updated MPL Activity and Data Analysis

[by] Mitchell Fox, Chief, Flight Operations Section, International Civil Aviation Organization

8.1.1 Presentation Outline

- What was ICAO tasked to do with regards to MPL?
- What method was used for data collection and analysis?
- What does the data show?
- What can we conclude from this?

8.1.2 What was ICAO tasked to do?

- 2006 “proof of concept” program started
- Aims to:
  - Evaluate implementation of MPL training programs
- As stated in PANS-TRG
  - Discuss relevant issues going forward
- 2007 ICAO solicited States to:
  - Collect data from ATOs that provide MPL training
  - Gather information on implementation status
- 2013 ICAO requested States to provide data on 5 modules:
  - State MPL regulations and oversight
  - MPL training program data
  - Data for each class of MPL candidates after graduation
  - Individual MPL graduate data (after final check)
  - MPL graduate initial line training and line-check (initial and second)

8.1.3 What method was used?

- Analysis was done with the help of the International Pilot Training Consortium (IPTC)
- IATA provided resources to help with data collection and analysis
- Comments in data helped to see what MPL represents in line pilot and improvements

8.1.4 MPL Training Program Data

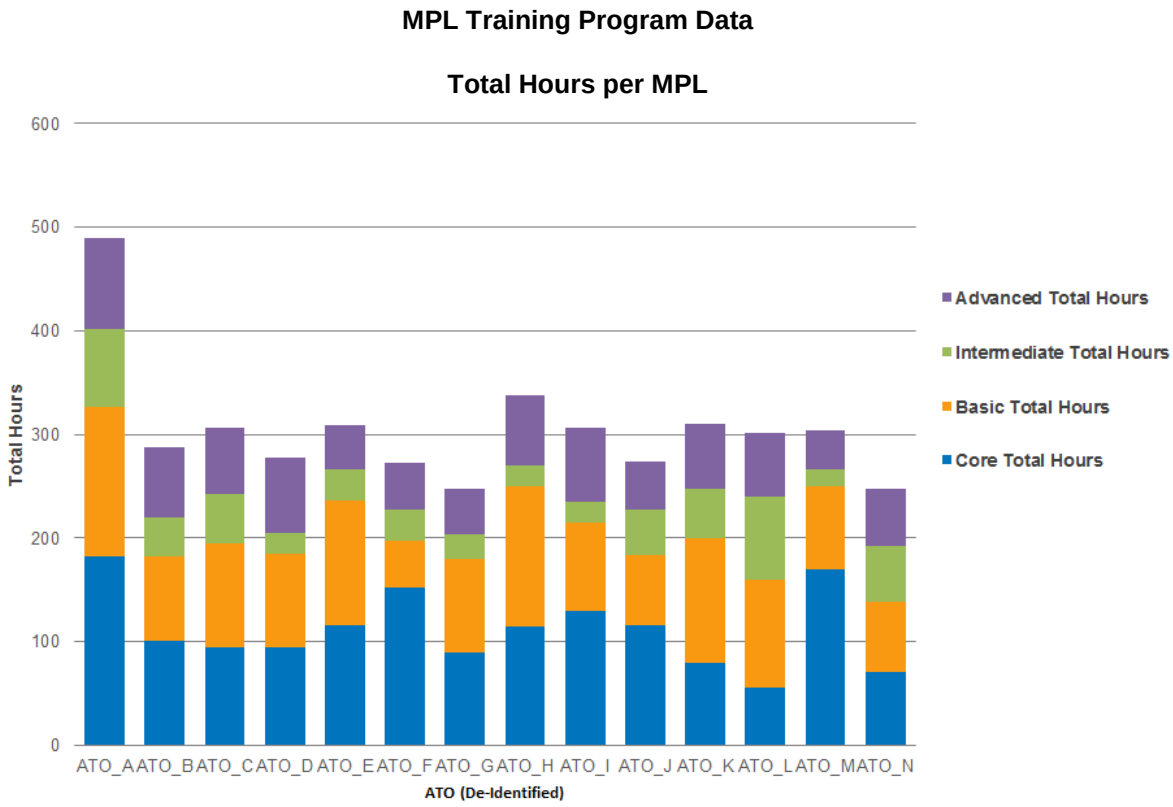
- 15 MPL program sets of data provided to ICAO
- All MPL programs have pre-selection process coordinated with an airline
- All States with MPL ATOs have qualification requirements for evaluators in each phase of the MPL programs
- Qualifications of evaluator in the Advanced Phase is required
- Is theoretical knowledge test conducted by State or by ATO?
  - By State: 9
  - By ATO: 2

8.1.5 What does the data show?

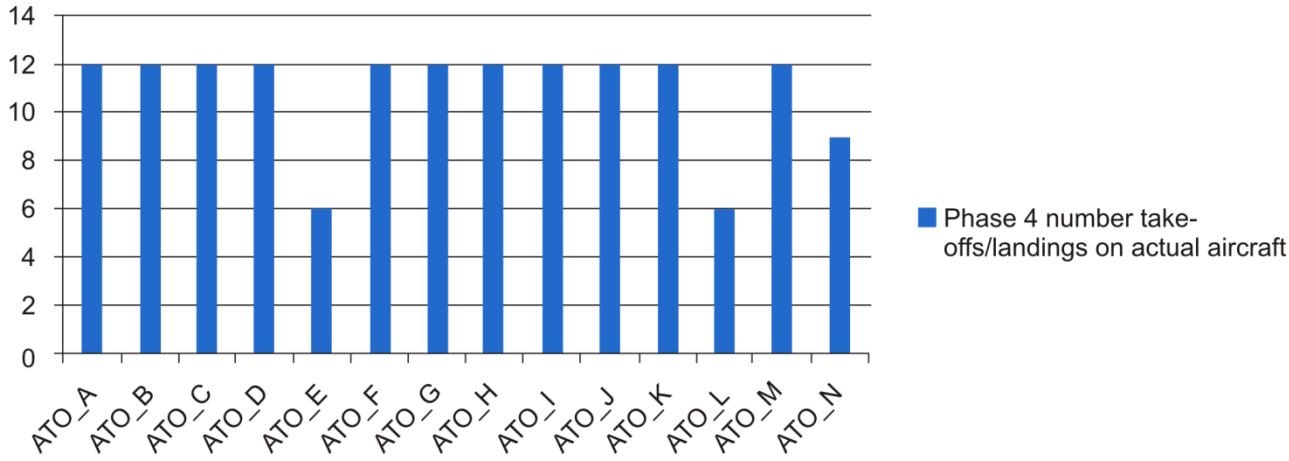
State Regulations

[see Section 17 and Attachment 1]

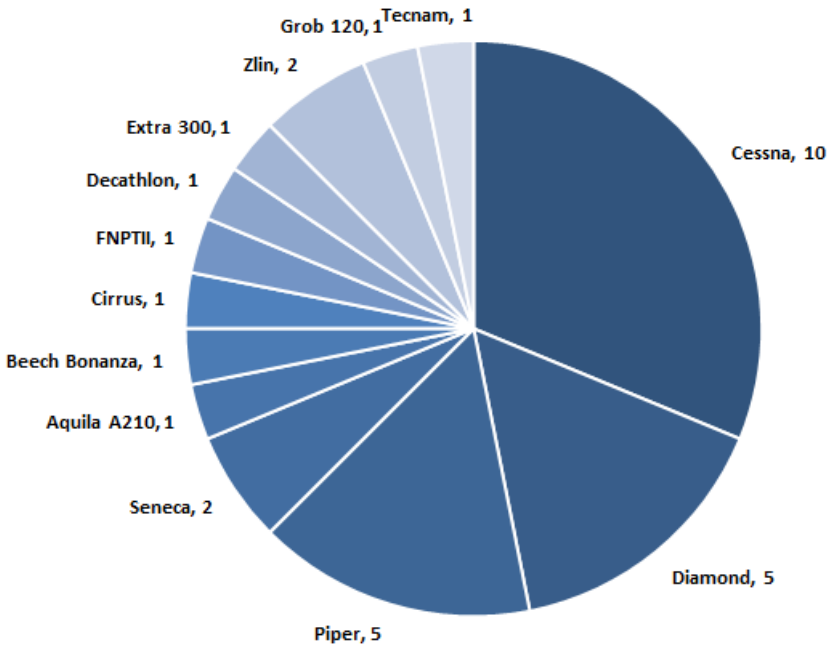
MPL Training Programs



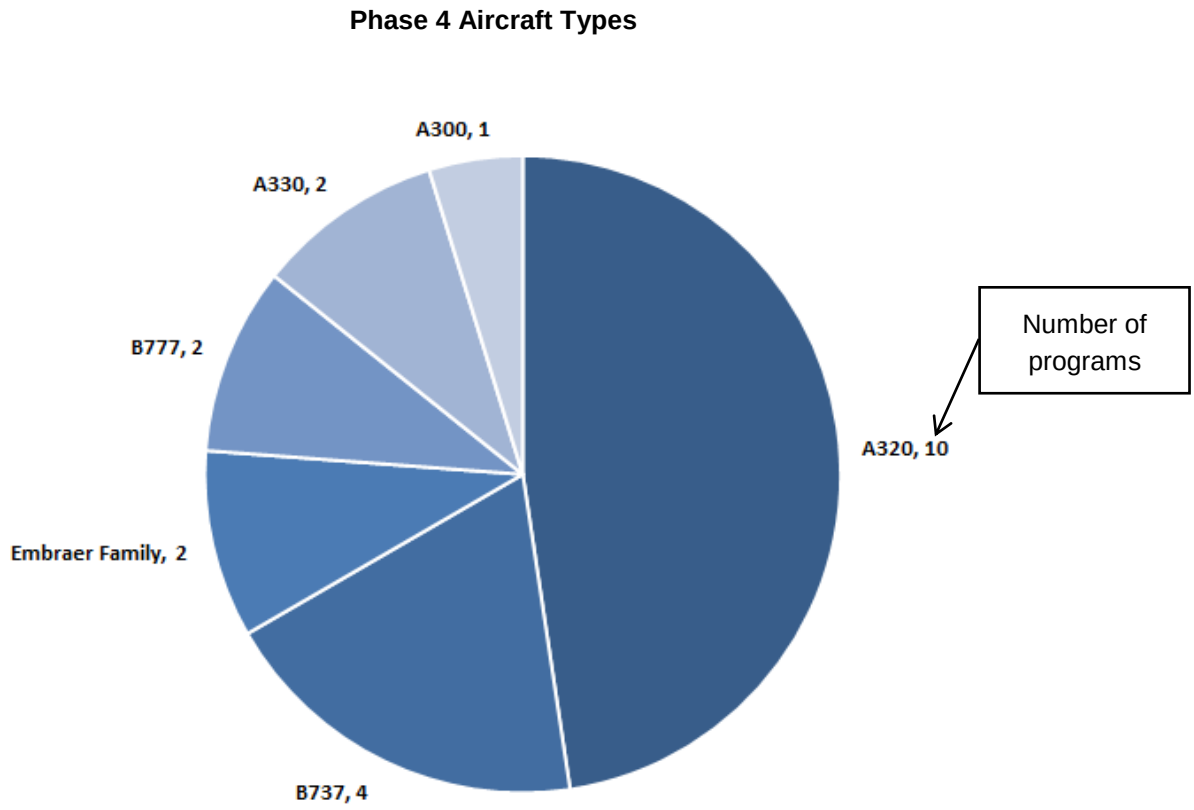
Phase 4 Number of Take-offs/Landing on Actual Aircraft



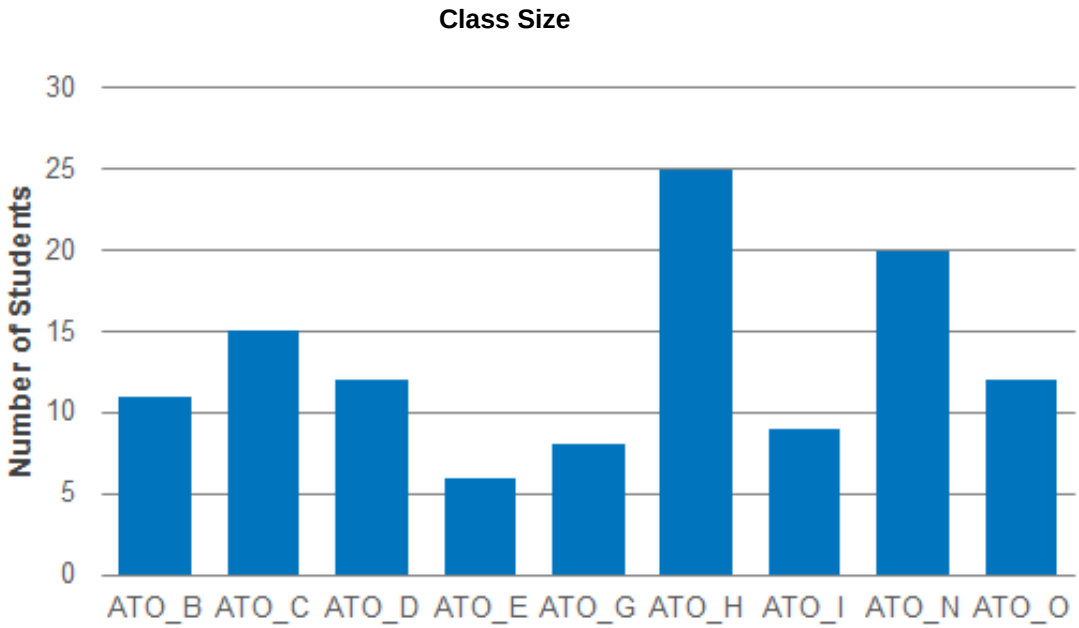
Phase 1 Core Flying Skills – Aircraft Types



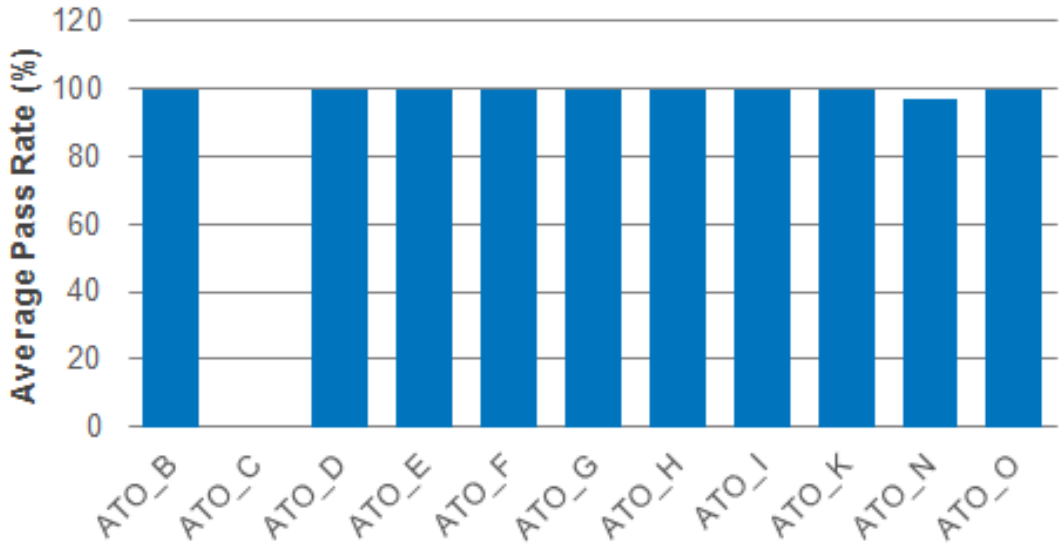
Note: Tecnam, Grob 120, Zlin, Extra 300 and Decathlon, listed above, are all aerobatic aircraft.



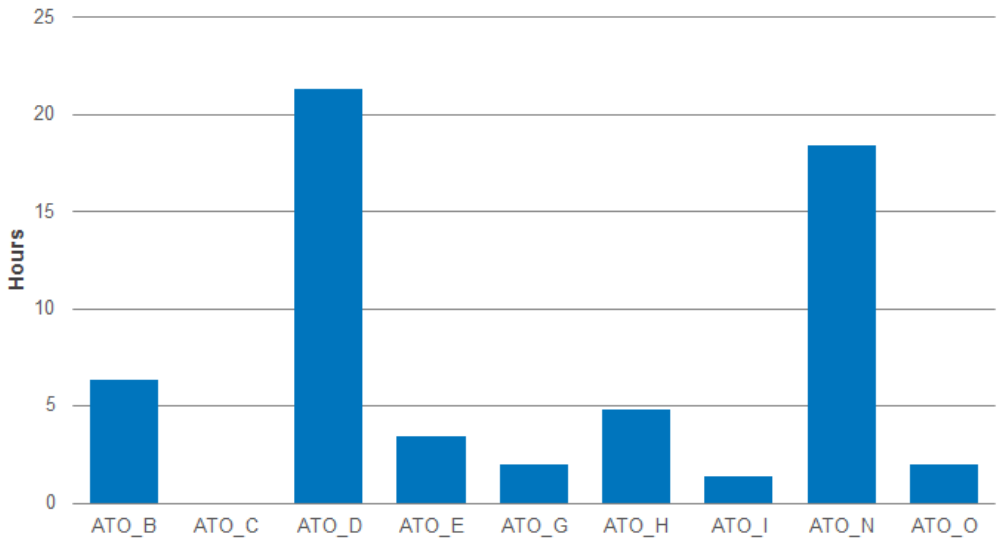
MPL Training Classes



Average Pass Rate



Additional Training Required



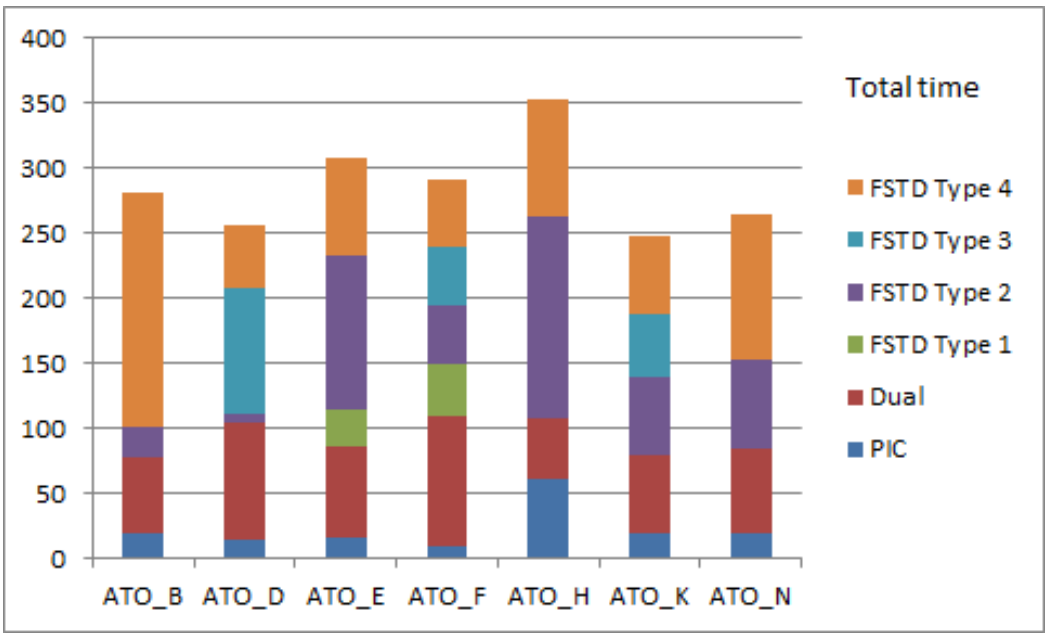
MPL Graduates

Individual MPL graduate data

- 586 data sets
- De-identified, but full of information

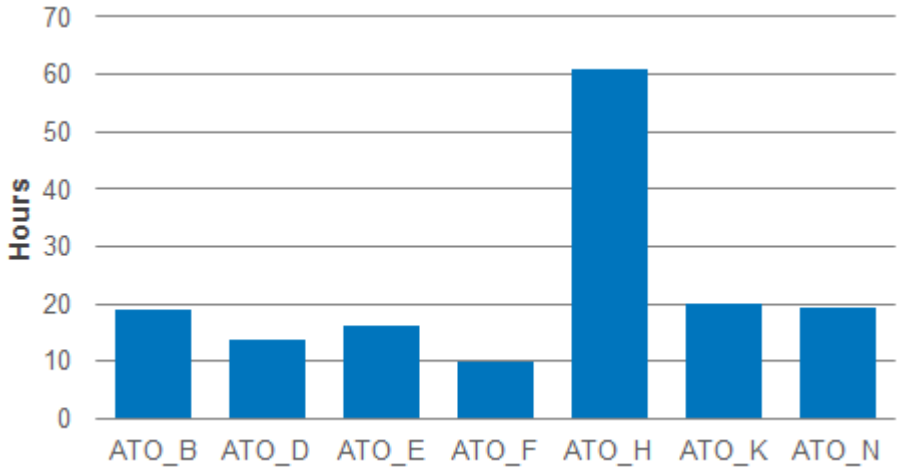
- Missing data: for most ATOs, the data only covers MPL students who took the final check, not the students washed out during the training
- Success rate is 100% for most ATOs, lowest rate is 98%

Average Training Times per ATO, per Device and PIC/Dual

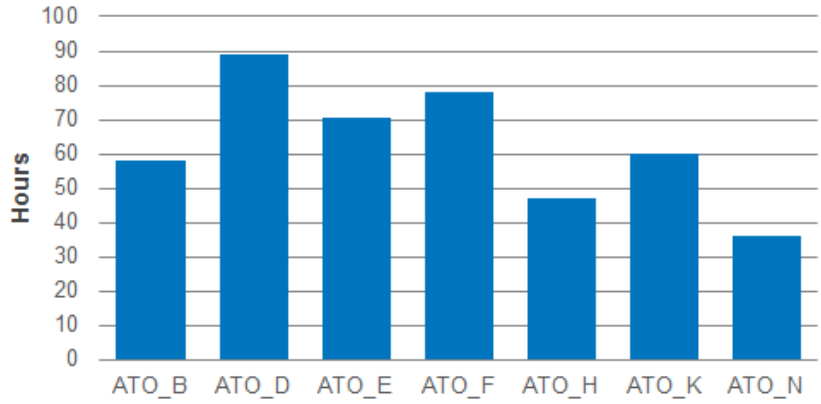


Average Training Times per ATO, per PIC/Dual

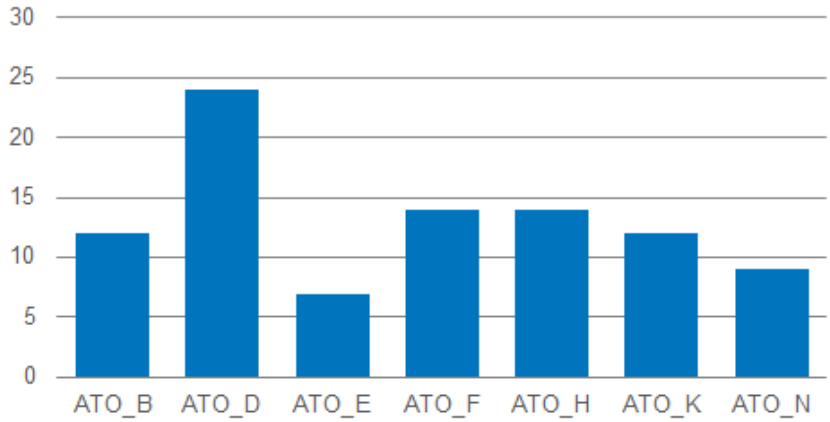
Average PIC/Solo



Average Dual

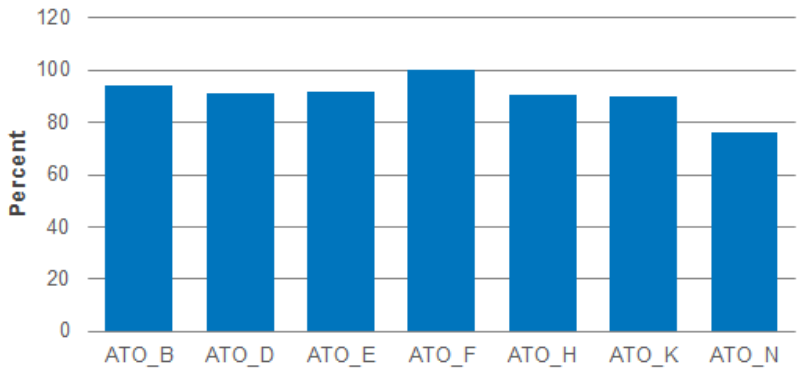


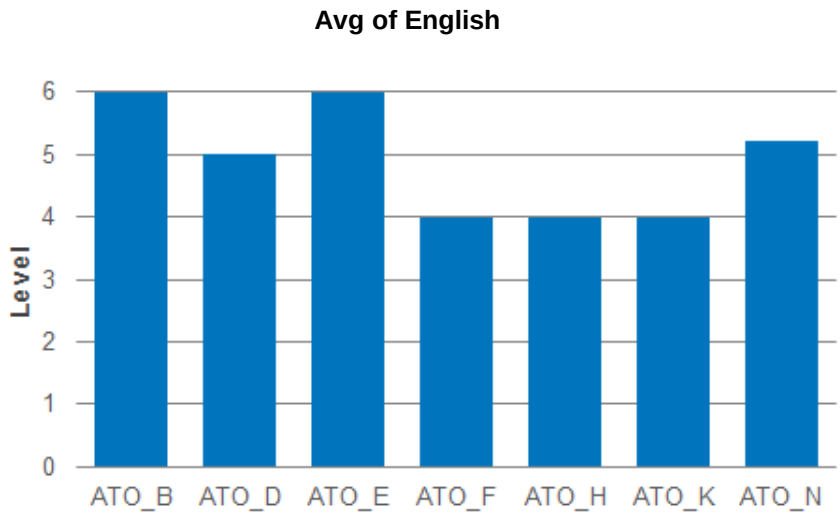
Average of Take-off and Ldg



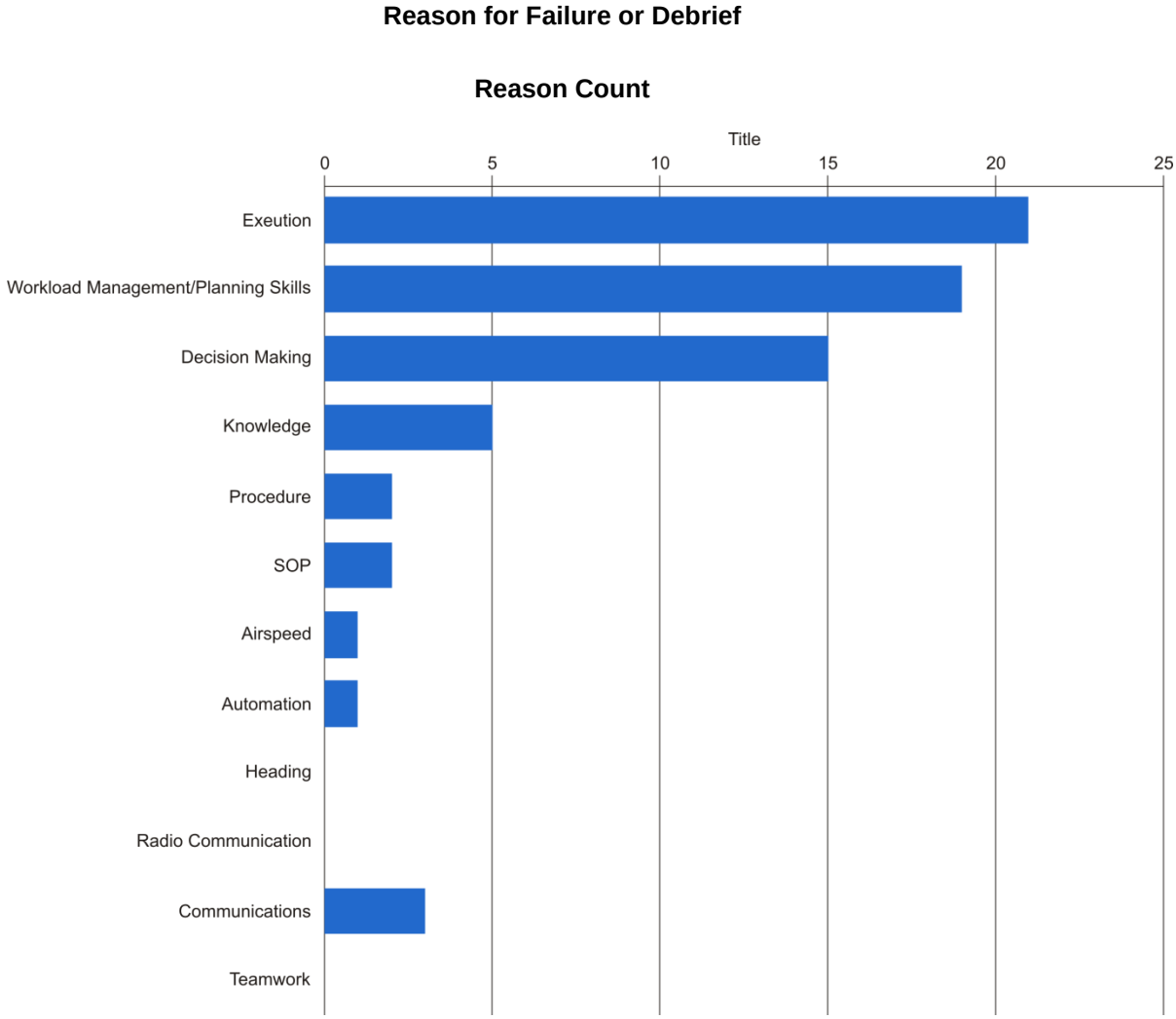
Knowledge Test Results and English Language Proficiency

Knowledge Avg





MPL Graduate Initial Line Training and Line-Check

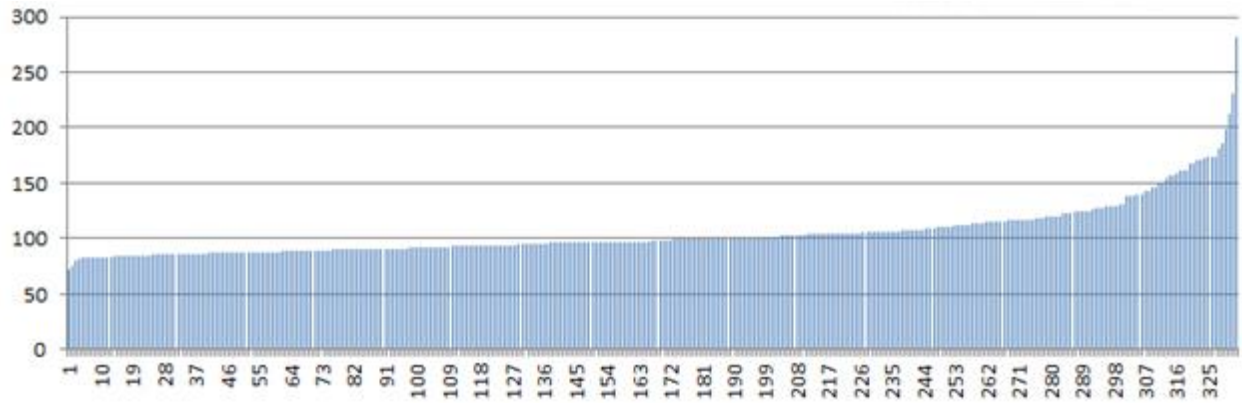


Maneuvers/actions leading to failure or debrief

Cruise	
Monitor Flight Progress	25
FMS/Navigation	8
Descent	
Descent Planning	13
Checklists & Descent Profile/Speed	13
Approach	
Approach briefing	4
Precision Approach	19
Non-Precision Approach	6
Visual Approach	4
Landing	
Flare/Touchdown	6
Normal Landing	19
Hand-flown Crosswind Landing	3

Number of Sectors

Average 105;
Min 72 – max 281



8.1.6 What can we conclude?

- From data received, the MPL concept is sound
  - Pre-selection is a major contributor to success
  - Failure rate is low
  - Caveat: large variations between MPL training programs but to be expected for CBT [Competency-Based Training]
- Some comments received:
  - Line evaluations consistently satisfactory
  - After training, graduates absorbed by sponsor airline
  - Most Captains a bit apprehensive initially but in line preferred to fly with MPL graduates more than others
  - Identified issue: ATC communications
  - Lack of data on progression from MPL to Captain
  - Selection of MPL students is a major contributor to success rate

8.2 [Day 3:] Session 11: Outcomes and Identified Issues

8.2.1 What was said

- Jim Dow throws the gauntlet to the attendees
  - Now is the time to face the challenge!
- IATA will support MPL implementation
- ATC simulation not meeting Doc 9625 criteria
- English language proficiency tough for non-native speakers

8.2.2 What did the Secretariat say?

- There is no plan to reduce required solo time
- ICAO material for on-aeroplane UPRT does not require aerobatic aeroplane capability. However, “use of aerobatic aeroplanes would be the optimum solution to providing maximum training value and safety margins” (Doc 10011, the Manual on Aeroplane Upset Prevention and Recovery Training, Appendix, Table App-2).

8.2.3 Outcome from Presentations

- MPL Proof of concept is about to be completed
  - MPL is a living concept
  - Meeting expectations
- Key elements for success:
  - Selection process
  - Competency-Based Training (CBT)
  - Competent, standardized instructors
  - TEM
  - Effective course design
  - Feedback system to improve training
  - MPL needs to be sustainable, repeatable with continuing improvement
- Oversight of MPL programs requires significant CAA resources
  - MPL-dedicated inspectors suitably trained
- Learning Management System is a necessity
  - An effective tracking tool
- UPRT required
  - ICAO provisions on the way

8.2.4 Regional/National Issues

- Knowledge delivery and testing need to be solved with the regulator
  - Mastery tests
- MPL graduates without job offer from operator
  - European regulatory issue
- Prescriptive instructor qualifications lead to shortage
  - Local issue as PANS-TRG instructor qualifications are competency-based
- MPL implementation
  - Real flight time/ FSTD ratio
  - Manual handling skills
  - Raw data instrument flying

8.2.5 Issues Identified for Discussion

- Amount of take-offs and landings on aircraft type
  - Either a major obstacle or a reality of competency-based training
- MPL ATO regulations need to be globally harmonized
- Call for data collection to continue
  - For MPL improvement and for promoting recognition of licenses
  - How to address the confidentiality of ATO data?
- Need for better inspector and examiner qualifications
  - In PANS-TRG and supporting guidance
- Competency concept to be reviewed
- Instructor qualifications/competence are crucial, as is calibration
  - PANS-TRG is good
  - Need for supporting Guidance Material (GM)?
- ATC communications is a challenge
  - Should ICAO provide GM for ATC communications training, with options?
- Guidance material to be upgraded in many areas
  - MPL course approval process
  - All co-pilots, command upgrade
- FSTD qualifications for MPL Phases II and III are prescriptive
  - An Acceptable Means of Compliance (AMC) should be to use FSTDs fit for the training purpose using Doc 9625, Part III “à la carte” option.
- Potential error in PANS-TRG 3.2.2
  - 3.2.2 checks engine parameters Ops. Manual PNF

    [corrected in 2nd edition]

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